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The University of the State of New York

NEW YORK STATE MUSEUM

68th ANNUAL REPORT

1914

In 1 volume

REPORT OF THE DIRECTOR 1914

AND

APPENDIXES 1-3

TRANSMITTED TO THE LEGISLATURE MARCH 31, 1915

ALBANY
THE UNIVERSITY OF THE STATE OF NEW YORK
1916

STATE OF NEW YORK

No. 32

IN ASSEMBLY

68th ANNUAL REPORT

OF THE

NEW YORK STATE MUSEUM

To the Legislature of the State of New York

We have the honor to submit herewith, pursuant to law, as the 68th Annual Report of the New York State Museum, the report of the Director, including the reports of the State Geologist and State Paleontologist, and the reports of the State Entomologist and the State Botanist, with appendixes.

ST CLAIR MCKELWAY
Vice Chancellor of the University

JOHN H. FINLEY
President of the University and Commissioner of Education

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University of the State of New York Bulletin

Entered as second-class matter August 2, 1913, at the Post Office at Albany, N. Y., under the act of August 24, 1912

Published fortnightly

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New York State Museum

JOHN M. CLARKE, Director

Museum Bulletin 177

ELEVENTH REPORT OF THE DIRECTOR OF THE STATE MUSEUM AND SCIENCE DEPARTMENT

INCLUDING THE SIXTY-EIGHTH REPORT OF THE STATE MUSEUM, THE THIRTY-FOURTH REPORT OF THE STATE GEOLOGIST, AND THE REPORT OF THE STATE PALEONTOLOGIST FOR 1914

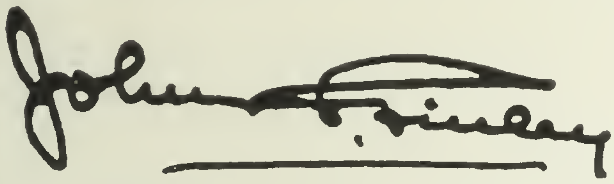
The University of the State of New York
Department of Science, March 29, 1915

Dr John H. Finley
President of the University

SIR: I have the honor to transmit herewith my annual report as Director of the State Museum for the fiscal year ending September 30, 1914, and to recommend it for publication as a Museum bulletin.

Very respectfully
JOHN M. CLARKE
Director

Approved for publication this 31st day of March 1915



President of the University

University of the State of New York Bulletin

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New York State Museum

John M. Clarke, Director

Museum Bulletin 177

ELEVENTH REPORT OF THE DIRECTOR OF THE STATE MUSEUM AND SCIENCE DEPARTMENT

INCLUDING THE SIXTY-EIGHTH REPORT OF THE STATE MUSEUM, THE THIRTY-FOURTH REPORT OF THE STATE GEOLOGIST AND THE REPORT OF THE STATE PALEONTOLOGIST FOR 1914

INTRODUCTION

This report covers all divisions of the scientific research and Museum work under the charge of the Regents of the University and concerns the progress made therein during the fiscal year 1913–14. It constitutes the 68th consecutive annual report of the State Museum, the 34th annual report of the State Geologist (consecutive since 1881) and the report of the State Paleontologist for 1914. It is introductory to all memoirs, bulletins and other publications issued from this Department during the year named.

The committee of the Board of Regents having supervision of the affairs of this Department are the Honorables: Charles B. Alexander M.A. LL.B. LL.D. Litt.D., Tuxedo; Francis M. Carpenter, Mount Kisco; Walter Guest Kellogg B.A., Ogdensburg.

The subjects presented in this report are considered under the following chapters:

I Condition of the Science Museum
II Miscellaneous Museum Affairs
III The Preservation of Natural Monuments
IV Report on the Geological Survey
V Report of the State Botanist

VI Report of the State Entomologist
VII Report on the Division of Zoology
VIII Report on the Division of Archeology and Ethnology
IX Report on the Publications of the Department for the Year
X Staff of the Department
XI Accessions to the Collections
XII Scientific papers in this bulletin
XIII Appendixes (to be continued in subsequent volumes)

I

CONDITION OF THE SCIENTIFIC MUSEUM

In the report of the preceding year, attention was directed to the progress made in the case equipment of the Museum and the installation of the exhibits therein. The first contract for Museum cases was entered into with George W. Cobb, jr, and under this contract 384 cases of 28 different types were called for and delivered. Some extended account with illustrations was given last year of these various types of Museum cases, it being thought that the information would be of service to other museums. As a matter of record it may be here put down that the workmanship on these cases was of a high grade and is proving not only substantial but satisfactory in all except a few minor particulars.

The installation has now proceeded to practically the complete equipment of all the cases that have been installed in the main hall, Mineralogy — Geology — Paleontology, there being in this hall only a few remaining where the exhibits have yet to be completed. In the Zoology Hall a number of cases have yet to be filled, especially those which were designed to hold the entomological collections. The designs of the State Architect for these cases were never complete and upon their receipt it was necessary to add new construction which required 450 joined and veneered panels which it proved very difficult to get satisfactorily made. The work upon these entomological cases is now approaching conclusion and installation will presently begin.

It became evident a year ago that the case equipment for the paleontology hall was inadequate and a contract was made with the Ely J. Rieser Company of New York for the construction of 37 additional cases of a new type designated as "AA," which have now been delivered and are in the process of equipment. These cases are of small size, with a straight back and desk front, designed to be placed against the walls, and have them arranged about the long walls of the paleontology hall.

The installation of the collections in archeology was for a long time obstructed by pending plans for the execution of the Iroquois group cases, and in the uncertainty as to the final form of these and their date of completion no progress could be made in this division of the Museum exhibits. The exhibits for this division have been assigned to the eastern and western mezzanine floors, an area which, except for the intervention of the rotunda, has the

full length of the building, 570 feet, and a width of about 50 feet. In the planning of the Museum, the easternmost of these mezzanine halls was assigned to botany, but the imperative demands of archeology have made it necessary to allot this space to the archeology division. A large part of the archeology cases which had been placed provisionally in the west mezzanine have been transferred to the east mezzanine and added to the equipment of the cases there and so arranged as to effect an orderly succession of the entire assemblage of cases. In these most of the archeological material, including the greater part of the valuable recent acquisitions, has been, in large measure, installed and the work is now in progress.

After many long and troublesome delays, a contract has finally been entered into for the construction of the Iroquois group cases and for the necessary electric wiring in connection therewith. This contract is in the hands of William Plass & Bro. of New York, and the work is about to begin. This order calls for the construction of 6 very large cases of concrete, steel and glass, to go in the western mezzanine, and until the work is done the Museum will not be in proper condition for opening to the public. It is quite likely that the quality of construction called for in these cases, to be carried out in the Museum halls, will prove a considerable embarrassment to the orderliness and cleanliness of the collections already installed. This condition, however, has to be met and, once passed, it may be hoped that the Museum will settle down to a permanent state of orderly arrangement.

Special designs for the Museum collections. The installation of the collections has called not only for the elaboration and effective display of actual natural materials, but has exercised the skill and ingenuity of the staff in the production of designs and restorations which would help to illuminate these collections. Perhaps it is true that the collection of invertebrate fossils has made the most exacting demands of this kind, because of the difficulties with which the comprehension of the fossil object by the ordinary observer is attended. It has been the purpose, so far as is reasonable and practicable, to make the structure of the extinct forms of life preserved in the rocks better intelligible by the help of such restorations and other forms of illustration. Attention was called in my last report to a number of these objects, most of which have been produced by the members of the staff, and occasion may here be taken to enumerate the restorations and models of various kinds recently installed for the purpose of serving the end indicated:

Model of down-draught brick kiln

Made by R. W. Jones

Model of oil derrick, shaft buildings and drill

The overground work by Donald Hansett and Raymond Sisson, boys of the vocational class in the Wellsville High School; underground work by N. T. Clarke

Relief model of Mormon Hill and the surrounding country, in the vicinity of Palmyra; an illustration of glacial drumlins

Model showing by a series of well sections, the varying depth of the salt-bearing strata in central and western New York

Made by R. W. Jones

Restoration of Archaeosigillaria, one of the earliest known trees

By Henri Marchand

Life-size restoration of the Giant Beaver (Castoroides ohioensis)

By Henri Marchand

One-eighth natural size reproduction of the glacial pothole in which the Cohoes mastodon was found

By Henri Marchand

The puma

Modeled and cast by Henri Marchand

Life-size restoration of the Devonic fish, Bothriolepis

By Henri Marchand

Additional restorations of Devonic fishes by Jaekel, Hussakof and others

Eusarcus habitat group; submarine view of these extinct scorpions

By Henri Marchand

Panel restorations in life dimensions of the extinct scorpions Pterygotus, Eusarcus and Stylonurus

By Henri Marchand

Restorations of the development of the extinct scorpions Hughmilleria, Pterygotus, Stylonurus and Eurypterus

By R. Ruedemann

Development series of the extinct cephalopod Manticoceras

By R. Ruedemann

Restorations of the cephalopods Gyroceras, Trochoceras, Piloceras, Manticoceras, Endoceras

By R. Ruedemann

Life-size restoration of Orthoceras

By N. T. Clarke

Full-size restorations of the largest of the known trilobites, representing the genera Terataspis, Homalonotus, Dalmanites

By Henri Marchand

Restoration of the phyllocarid crustacean Mesothyra

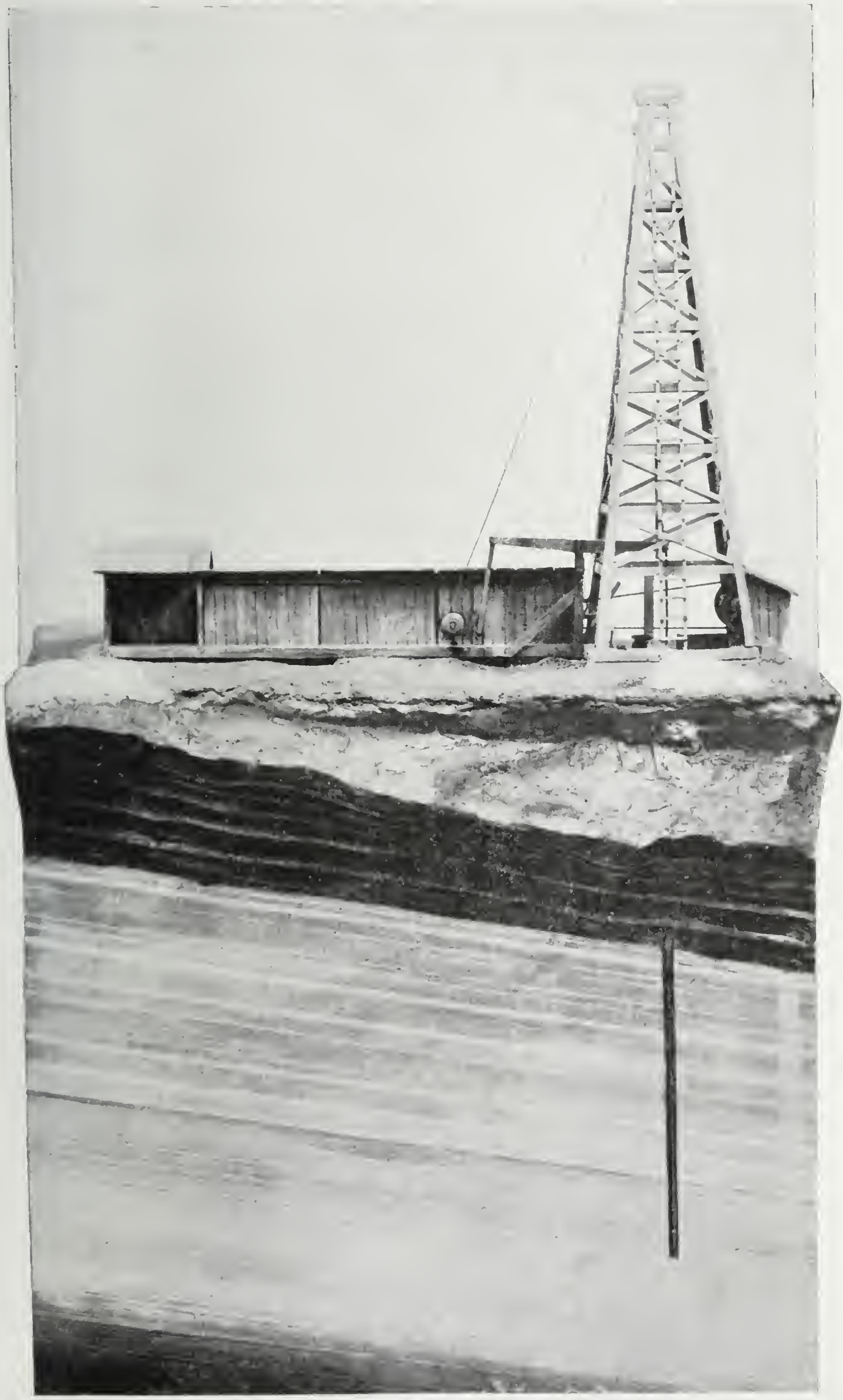
By Henri Marchand

Life-size panel restorations of dorsal and ventral surface of Hughmilleria and Eurypterus

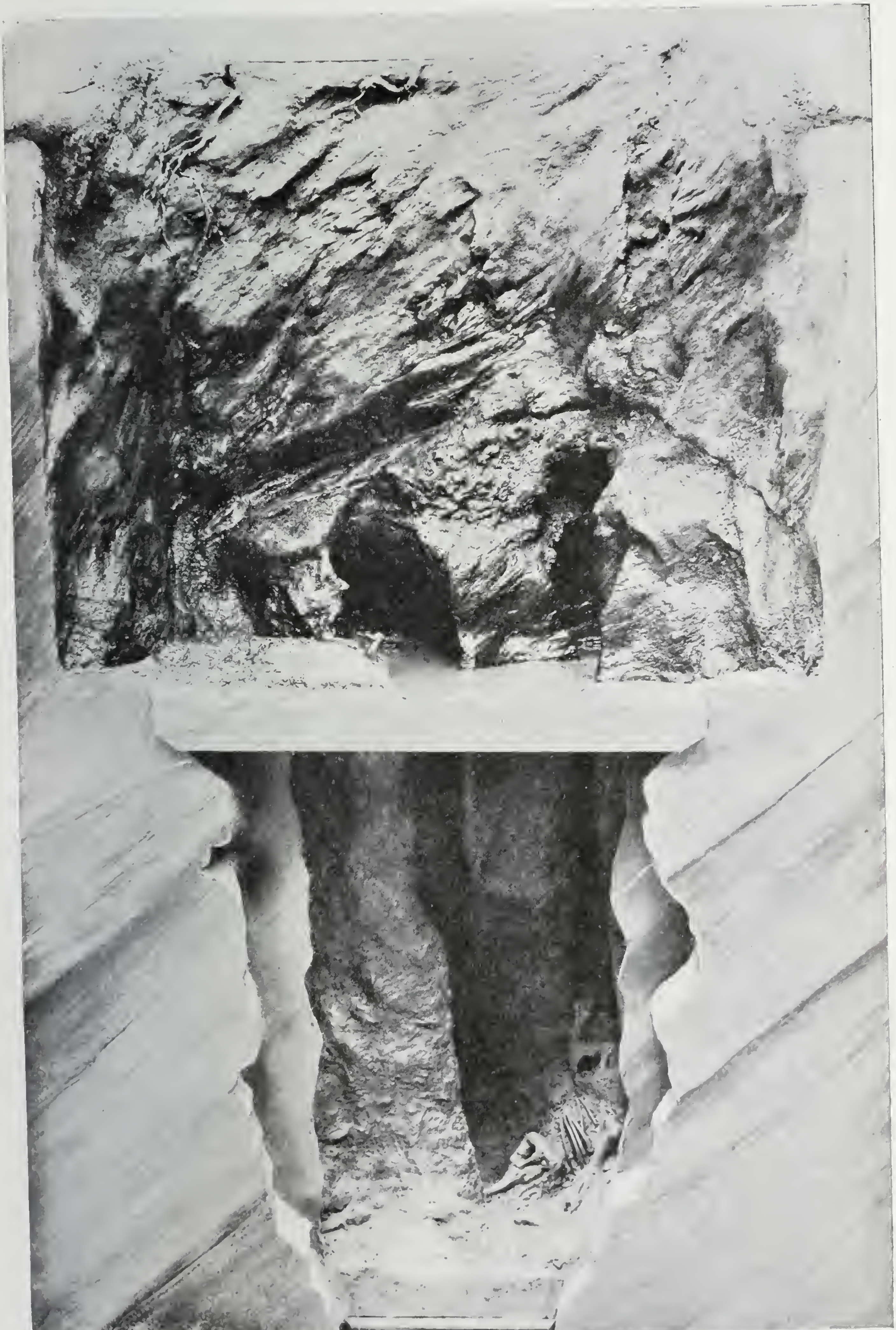
By G. S. Barkentin

General Museum matters. For a year past the funds of the Museum have been too low to hasten the progress of the work. It has been necessary to fall back practically to the appropriation which for years has been made without change for the maintenance of the entire work of the Science Division, regardless of the added cost and responsibility of Museum equipment. Should anyone be disposed to intimate that the equipment of the Museum was not advancing with expected celerity, here lies the cause.

The present quarters of the Museum are in many ways attractive and capacious but are far from presenting ideal conditions for a museum of any kind. The space available for the display of the scientific collections is wholly inadequate and compels the contraction of these collections, even though they are planned to represent only the natural resources of New York State, to much less, both in quantity and quality, than they ought to be and much less than the actual possessions of the Department would permit. This very fact has required the most careful and serious consideration in the selection of the superior material only for exhibition purposes, while very much that is good and instructive and equally important to have accessible, remains and must continue to remain out of sight on account of this lack of adequate room. This is a serious obstacle to the development and future growth of the Museum, and there is not much satisfaction in looking forward to the time in the immediate future when it will be necessary to regard the Museum as finished, for such a condition implies stagnation and will fail to measure up both with the public interest and the demands of the science, were it not that we may anticipate with reasonable hope the time when the science museum, together with the other museums which, though not yet realized, are contemplated in the organic law governing the State Museum, will be installed in its own building, free of entanglements with interests not wholly germane to its own.



Model of an oil-well and derrick



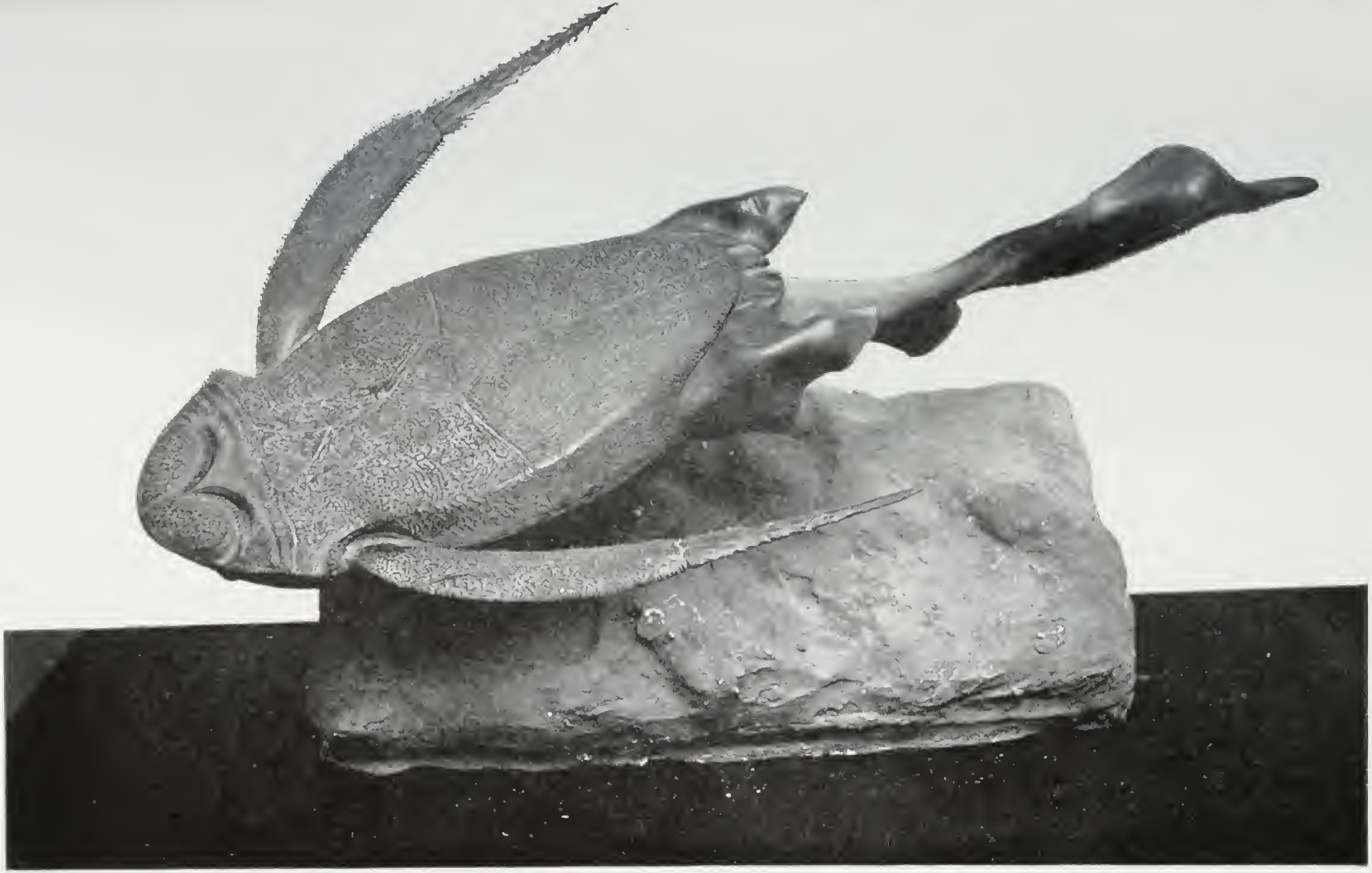
Restoration of the great glacial pothole in which the Cohoes mastodon was found. One-eighth natural size
By Henri Marchand

THE PUMA

By Henri Marchand

A Devonic fish (*Bothriolepis canadensis* as restored by Patten)
Modeled by Henri Marchand

Profile of the same model



Ventral surface of Bothriolepis, by Marchand

Restorations of a small Devonic fish (Cephalaspis Patten) by Marchand

II

MISCELLANEOUS MUSEUM AFFAIRS

The functions of the State Museum and the codification of the Museum law. It has been often pointed out in the reports of this Department that the function of the Museum, as indicated by the law establishing it as a department of the University, is very broad in its character and provides for the existence at the center of government of a great central museum which shall cover the entire field of museum activities and service. It happens that the State has not as yet developed any part of this central museum except the museum of science. The efforts of the Director during a number of years past to initiate a museum of history are a matter of record. With equal force the law provides for a museum of art, of agriculture and the industrial arts and of education. Furthermore, while the essential organizing law of the museum is brief and very broad in its scope, the definition of the educational functions of the State Museum is somewhat extended as it now stands in the Education Law. The Education Law defines the relations of the Museum to a system of free public museums; it provides for and defines the procedure in the establishment of a system of free public museums; it makes provisions for grants of money to such museums, subject to the approval of the Legislature, and particularizes with great definiteness the safe-guarding of the property of such museums. Neither the State Museum nor its affiliation with free public museums has been developed along the lines indicated by the outstanding Education Law. This may be due to several considerations, among them the fact that the Museum has but recently come into visual evidence as a factor in the educational service, notwithstanding its long history as a creator of new knowledge; and the further fact that this law relating to the scope and functions of the Museum respecting its affiliation with free and public museums and with respect further to the organization and development of such free museums has been hidden away in the statute book under other designations. All the outstanding laws pertaining to the functions of the institution have been assembled with a view to their codification, and this body of law, which may be properly termed the "Museum law," may well be formally incorporated as a special chapter of the Education Law. There are certain outstanding functions which the Museum actually performs but which it does not execute as a department of the University, such as the

work of the Board of Geographic Names, which was established under an executive law, and it seems a very proper procedure that this work should be formally taken over by the University.

It may be said that the law relating to the functions of the Museum provides in every way adequately for the highest development of the museum idea as a part of the education service. To carry out this idea and attain the end actually contemplated in the enactment of this law is the most worthy end which the Department in its relations to the University and its relations to the people of the State, can hold before it.

Grants to public museums. The right exists in law to make grants of money to public museums on the same basis as grants of such public moneys are made to the libraries of the State. It is believed that a number of struggling local public museums in the communities of the State would be encouraged to much greater usefulness and activity if such recognition by the State could be assured to them in accordance with the evident intent of the law.

Traveling scientific collections. The possibility of putting into circulation traveling scientific collections which might serve the schools, school centers and other educational agencies of the State, has been brought forward for consideration and received careful thought.

The proposition is not a new one, nor is it outside the experience of the State Museum. The situation in New York is somewhat different in this regard than in other states where such movable scientific collections are in use. Here the central museum of the State is distinctively a State Museum and it is not within its scope to enter into competition with what may be called " world museums."

To be effective, it is evident that the circulation of scientific collections must be among the students of natural science and principally of our schools. Twenty-five years ago the curriculums of the schools allowed opportunity for the study of geology wherein would lie a strong appeal of such scientific collections. Today this science is not taught in the secondary schools. It is probably correct to say that in the adjustment of courses for the lower schools the vast preponderance of the pupils of this generation is deprived of the opportunity to acquire the knowledge that was freely at the command of their fathers and mothers.

Many years ago when the State Museum was accumulating large quantities of geological specimens for the perfection of the Paleontology of New York, it was the wish and order of the Regents

that the excess of specimens then acquired be distributed to certain schools of the State. A list of about fifty schools, made up largely upon the application from the schools themselves, was approved by the Board and collections were sent to these from time to time, all duly labeled and explained. Today only occasional traces of these collections are to be found, most of them having been thrown together or thrown away in careless disregard. The effort was a fruitless one. It resulted in little good to the schools and in considerable damage to the State Museum until by a formal vote of the Regents the sending out of collections to the schools was discontinued.

In the present status of natural science in our lower and secondary schools there seems little practical objective in the somewhat costly enterprise of circulating general traveling collections of scientific objects. We are not aware that in any of the older and more experienced countries of the globe efforts are made to disseminate knowledge in this way even where the sciences are still honored as fundamental factors of an elementary education. Experience has taught them that the youth who would know geology or botany or zoology or whatever science, must be encouraged to make his own observations and his own collections and not be overwhelmed by a burden of illustrations from all parts of the world which are beyond his powers of assimilation.

Much more efficient, as a factor in science training, would be the encouragement of every school in the establishment and maintenance of a *school museum,* the museum to be subject to inspection and supervision by the Museum Department. But even this would be effective only when the teacher of science in the schools is made to inspire an interest in the upbuilding of such museums.

Birds of New York. During the past year volume 2 of Birds of New York, which constitutes State Museum Memoir 12, was published and distributed. These two sumptuous quarto volumes have aroused a widespread interest and the demand for them has been very large, even though they have been for the most part restricted to sale. On account of the small edition of the work and its large size, made necessary by the lengthy descriptive accounts of every species of bird occurring in the State, and the high price attached to it, the work in this form has not reached the public so fully as desired, and it has been thought best to widen the usefulness of this publication by issuing more freely a reprint of the 106 color plates. As these plates carry the names of the birds, it is thought that they will serve an effective purpose, even without any

accompanying descriptive matter. There are now being issued 15,000 copies of these plates, printed on an inexpensive paper, without serious loss of color effect, and bound in cloth portfolios. It is the purpose to place one of these books in every school in the State, excepting such of the high schools as have already received the larger volumes for their libraries. It was decided to hold volumes 1 and 2 of Memoir 12 for sale at $6. This cheaper edition of the plates can be sold at 60 cents, and those remaining, after the distribution to the schools, will be so held for sale.

The State mining exhibit at the Panama-Pacific Exposition. A collective exhibit of the mineral resources of the State and their industrial applications has been prepared for display at the Panama-Pacific Exposition which is to be held in 1915 in San Francisco. The plans for the exhibits were approved by the State Exposition Commission who granted an appropriation to cover the cost of assembling the materials and their installation. It will be displayed on a site of 3360 square feet in the Palace of Mines and Metallurgy.

The exhibit includes a fairly complete assemblage of mine and quarry products — in variety scarcely inferior perhaps to that obtainable in any other state — besides many chemical and metallurgical materials in whole or in part derived from the local resources and much illustrative matter in the way of models, photographs, maps and charts. Although the collection has been brought together with a view more especially to illustrating the technologic and commercial features of the subject, for that is the main purpose to be subserved, nevertheless there is much of popular interest and much attention has been given to the explanation of technical methods and processes so that they will be understood by the general visitor.

The scope of the display as well as the form of the individual exhibits, has been controlled to a considerable extent by the limited time available for preparation and the distance to which the exhibits must be transported. The funds available for the purpose also were less than in the case of some of the previous expositions in which the Geological Survey has participated, although an actual increase in many items of expenditure was to be foreseen.

The exhibits in most instances have been provided by the mining enterprises themselves in conformity with the plans of Mr Newland who has had charge of the exhibit and the efficient assistance of Mr A. C. Terrill as the field representative. The cooperation of the

individual exhibitor has been the important element in the undertaking, and that it has been so freely extended has greatly lightened the task of those in charge as well as added much to the interest of the exhibits, for in many instances it has far exceeded the anticipated results.

The features which have the most popular appeal undoubtedly are the models that illustrate methods of extraction and preparation in current use by local enterprises. Among these is the model of a modern salt works, which represents to scale the plant of the Worcester Salt Co. at Silver Springs and is so constructed as to show the various steps of manufacture as if in actual progress. The making of salt by evaporation of brines is one of the historic mineral industries in the State and one in which New York still holds a very prominent place. A second model shows the operations of salt mining at Cuylerville, Livingston county, where the Sterling Salt Co. is engaged in producing rock salt from deposits that lie at a depth of over 1000 feet. The mine model is accompanied by a vertical geological section from the surface to the salt horizon. The use of salt in the manufacture of soda products — caustic, carbonate, bicarbonate etc.— is illustrated by means of a large colored diagram prepared by the Solvay Process Co. which traces the process from the extraction of the brine, the coal and the limestone through the chemical reactions to the final products, of which representative examples are shown.

The manufacture and some of the important uses of Portland cement are illustrated by materials, models and photographs contributed by local companies and by the Association of American Portland Cement Manufacturers; the display of the latter takes the form of a model of a cement road as constructed in New York State with a background of colored transparencies (illuminated) that depict the various stages of road-building amid typical New York scenery. In the exhibit of limestones and lime manufacture are included some remarkable specimens of calcites both in groups and single crystals from the quarries at Sterlingbush.

An extensive collection of iron ores has been brought together from the more important occurrences within the Adirondacks, the Clinton belt and the southeastern Highlands. The Mineville deposits are well represented by samples of the crude and concentrated magnetites and of the derived furnace products. A collection of minerals and rocks assembled by the engineering staff of Witherbee, Sherman & Co. during a period of several years illustrates the geological occurrence of the magnetites in the eastern

Adirondacks, and a group of photographs contributed by the same company show the surface and underground equipment of the Mineville mines, the sociologic conditions and other features of interest. The peculiar configuration of the largest of the Mineville deposits, the so-called Old Bed, is brought out by a glass model.

The exhibit of titaniferous magnetite from Lake Sanford, although the ore is not actively exploited at present, has current interest on account of the experiments that have just been carried out at Port Henry in its use in the furnace. A full set of the materials employed and the product from the furnace run is included.

The small petroleum industry is represented by samples of crude and refined oils from the fields in Allegany and Cattaraugus counties. A typical oil-well rig, such as is employed in that section, is shown by a model to scale prepared by a pupil of the Wellsville public schools.

The unique garnet mines of Essex county have contributed samples of the garnetiferous rock and the prepared products, among the specimens being a large block of the Gore mountain amphibolite containing several crystals. The uses of the garnet are exemplified by suitable displays.

Graphite is another interesting product of the Adirondacks that is represented. The exhibits illustrate the crude material, its conversion into marketable forms and the various applications of graphite, prepared by the principal enterprise of the kind in the country. Artificial graphite, which is made at Niagara Falls, is also exhibited, as well as a model of the electric furnace employed in the process. Other electro-metallurgical products in the display include carborundum, aloxite and silicon from the works of the Carborundum Company at Niagara Falls.

Among other products represented in the exhibits are pyrite, talc, feldspar, gypsum, slate, building stones and mineral paints. They are shown usually in crude samples as they are taken from the ground and in the various stages of preparation they undergo before being put to commercial use. To illustrate the geological associations and distributions of the various useful minerals a large scale chart of the State in water colors has been prepared which will be placed in a central position for reference. The separate mineral localities are shown by pins with heads of different colors and patterns. The chart is bordered on either side by statistical diagrams giving the relative positions held by New York in the several mineral industries.

The State Reservation Commission at Saratoga Springs will occupy a part of the area that has been assigned to the mining exhibit for a booth in which to demonstrate the recent advances in the therapeutic application of the waters and the results achieved by the commission in the revival of the springs. The cone of the High Rock spring is shown by a model. The natural surroundings of the spring localities are fully depicted in photographs.

III

THE PRESERVATION OF NATURAL MONUMENTS

Some years ago the Director made an appeal to the people of the State through his reports and by special circular, for the preservation of "natural monuments" of noteworthy or exceptional interest. These natural monuments are objects which possess a peculiar educational and scientific value; the extraordinary or unique natural creations which no progressive commonwealth appreciative of its best possessions can afford to have invaded or compromised by the progress of settlement. There is the cliff or hill, ravine or cataract, notable above its fellows not so much for its beauty or majesty as for the lessons it teaches; the tree or grove which may be the last survivor of its kind growing within the boundaries of the State; the swamp, woodland or rocky islet where rare birds are still nesting while their former breeding places have been deserted and destroyed; and so on through a variety of natural phenomena. Unless someone looks after these natural possessions and makes it his business to arouse individual or public concern in them, regrets will come with time and our successors may have good reason to reproach us.

The people of the State have taken upon themselves the conservation of our natural possessions in a large sense as an ordinary matter of public policy. Nearly one-third the area of the State is in public forest; our native beasts, birds and fish are safeguarded by an elaborate and rather intricate array of statutes. A generous and high-minded sentiment has gone much further than this, in creating as public parks great areas of extraordinary scenic attractiveness. Each one of these majestic reservations, now in the custody of the people for their own uses and enjoyment, has meant individual initiative, generosity and sacrifice and, in many cases, long and unremitting struggle within and without the legislative halls in order to convince a sometimes overcautious or uninformed legislature of the wisdom of assuming these public trusts. There are the Niagara Falls Reservation, the Watkins Glen Park, the Palisades Interstate Park, the Saratoga Mineral Springs Basin, Letchworth Park on the upper Genesee river, and more recently the John Boyd Thacher or Indian Ladder Park of the Helderbergs which, like the Letchworth Park, is a fine expression of an individual benefaction to the people of the State.

These great possessions are practically geological parks, for all their merits of beauty and the basis of their effective charm is in their geological structures. Niagara Falls, the "time-piece of the ages," the "geological clock," aside from being the most stupendous exhibit of water power in the western world, has been for generations and is today the object of study by geologists who seek a basis for the reckoning of geologic time, for the rate of action of geologic forces, for the record of changes in the topography and drainage of the Great Lakes basin. Watkins Glen is a deep gorge in the old Devonic shales which has been cut out since the withdrawal of the ice sheet and its inviting, sinuous retreats and deep, shady recesses hid away among graceful rock walls, stand as a monument of the geologic work of erosion done since the close of the Ice Age. The Palisades are an outpoured lava sheet whose prismatic edges have been bared by the flow of the ancient Hudson waters. The Saratoga Mineral Springs Basin, not conserved for its scenery but for the eventual benefit to public health, is an extraordinary geological monument and record, probably nowhere to be equalled in the diversity and abundance of its carbonated waters. Here, running through the village of Saratoga Springs, stands the escarpment of the celebrated "fault," the only outward sign of the controlling causes of these variant waters. Westward across the fissure in the earth's crust made by this fault, none of these abundant saline waters pass. Coming into the Saratoga basin deep underground, they encounter the carbonic acid gas emanating from this fault fissure and with this added solvent power they take the salts out of the rocks in varying degrees, till reaching nearer to the fault itself, they spring out to the surface at any chance, impregnated and supersaturated with the gas. Dead a few years ago because the gas was being pumped away, today they are again full of life and promise, with the hard hand of the law forbidding any further abstraction of their vitality.

Letchworth Park embraces the three beautiful and impressive falls of the Genesee river plunging down through a deep gorge in the rocks — a course its waters took after the ice sheet had blocked and filled up their ancient and easier channel. They too have done all this majestic work since the last great change in our geology, the retreat of the Great Glacier.

Thacher Park conserves a magnificent escarpment in whose rock face is recorded a long chapter in the life history of New York and from whose summit one reads the whole panorama of the great Hudson-Mohawk gateway.

These are our greater natural monuments in the possession and conservation of which this State is rich not only in scenic beauty but in educational service.

But the lesser object, the minor natural feature, may carry a lesson and express a sentiment quite as important and uplifting as the greater, and of these we have added to the public domain some of very notable concern.

LESTER PARK OR THE " CRYPTOZOON LEDGE "

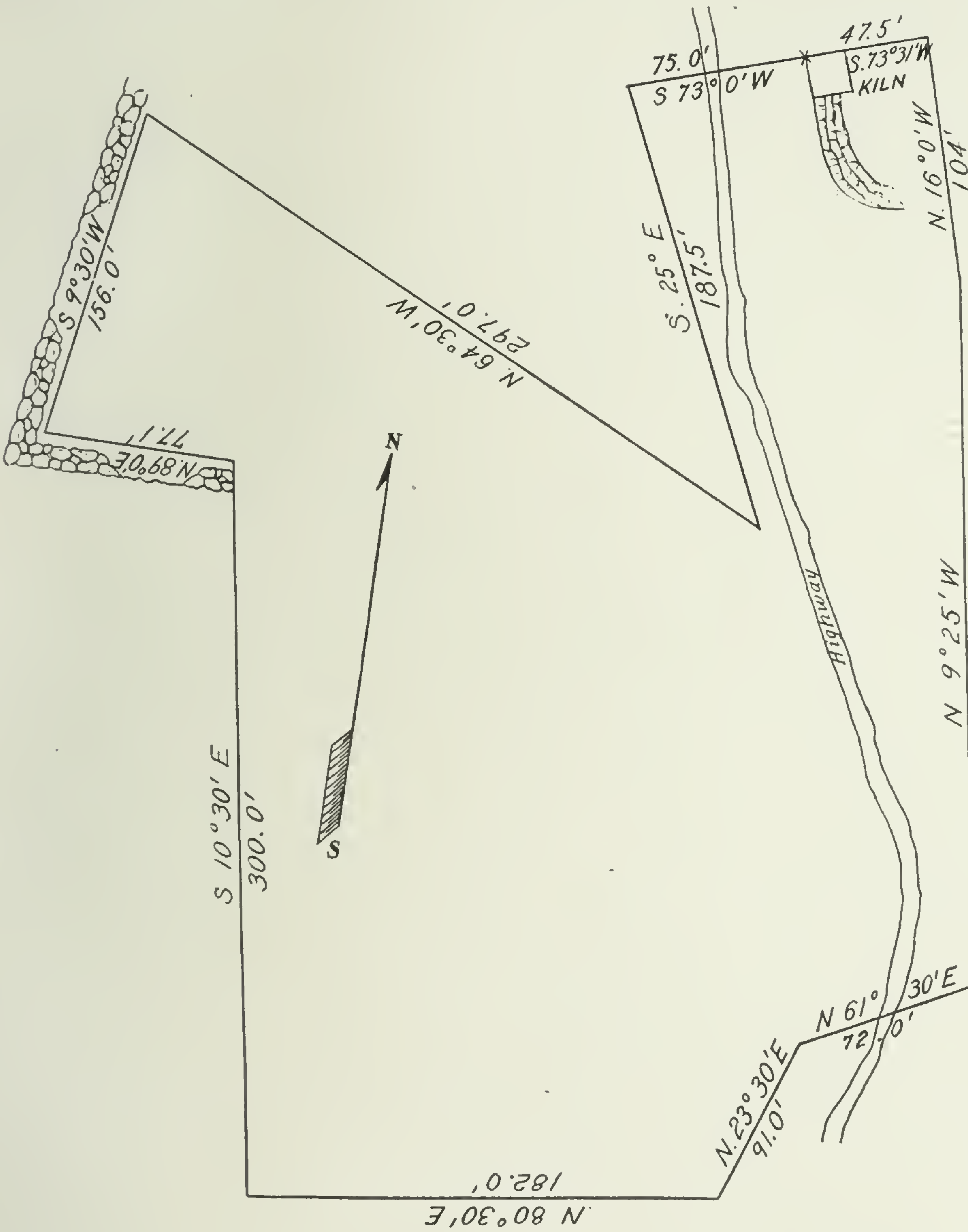
About 2 miles west of Saratoga Springs, in the town of Greenfield, Saratoga county, and just a little turn to the left from the State road, lies the first of these acquisitions. It is the gift of Willard Lester, Esq., of Saratoga Springs, to the Regents of the University on behalf of the State Museum and in trust for the people of the State. To use the language of the deed,

" This conveyance is made upon the express condition that said premises are to be used for the protection and preservation in their present site of the fossils exposed in the limestone strata upon the lands hereby conveyed to the end that they may be always available to the people of the State of New York for purposes of examination and study and to be used for no other purpose whatever."

This area covers about 3 acres of ground which is crossed by a highway and is thus readily accessible to the public. The spot is one of singular natural beauty, bounded on one side by a ravine, on the other by rising hill land, the road leading down into a wooded shady retreat and soon coming back again into the main highway. On one side of the road lies the " Cryptozoon ledge," a broad platform of Cambric limestone covering a half acre or more, smoothed down to a horizontal surface by the wear of the ice sheet. This ledge is filled with the remains of some of the earliest marine plants known to have lived in the ancient seas — lime-secreting algae, known in science by the name Cryptozoon proliferum, — which here grew in such amazing abundance as to form a great calcareous reef not unlike the coral reefs of the present seas. The Cryptozoon grew like great cabbages, in large round heads and in concentric layers, and the cabbagelike plants of this marine garden, dating back to the dawn of the earth, have been sliced across by the cutting edge of the glacier so that the surface of the Cryptozoon ledge presents an innumerable array of these cross-cut plants. The weathering agencies of untold centuries have brought out all their peculiar internal structures, their concentric layers, their buds and offshoots, while the microscope turned upon carefully prepared thin

sections of the fossils may reveal the bacteria which helped in the deposition of their lime.

This place had been long known to geologists for its remarkable display of these very ancient organisms and it is beyond question quite unique in the effective panorama it presents. It had, however,



Map of Lester Park
Property of the State Museum

begun to suffer from invasions by the collector of specimens for museums and to protect it from further incursion the Director asked the owner to transfer it to the State Museum. The answer to this request was expressive of a fine sentiment. Not only was this ledge freely given but to it was added, at the owner's suggestion, a larger area on the other side of the road where lie the higher ledges running out into a natural rock face and rising through a wooded

depression into the front of the old Hoyt limestone quarry — a spot of historic interest in New York geology for from it the name of the geologic formation itself — Hoyt limestone — is derived.

It is the purpose to provide this " Lester Park " with explanatory placards which will make clear its lesson and its interest, and to take such measures as may present the geological display here in its greatest effectiveness.

STARK'S KNOB

At the north end of the Saratoga battlefield, 2 miles above Schuylerville and close to the highway, stands Stark's Knob, a once dome-shaped volcanic knoll on which, on that memorable and decisive field, General John Stark mounted his battery and effectively obstructed the attempts of the defeated Burgoyne to withdraw his forces northward through the narrow valleys of the Hudson and the Battenkill. It is an historic spot. But its geology is of more singular interest. Some years ago its owner leased the knoll to a company that cut into its eastern face to obtain the rock for road metal. Fortunately for geological science the rock, though volcanic, has proved unsuitable for good road construction. The exposure of its substance attracted the attention of our geologists and it became evident that the rock was not merely of volcanic origin but was the actual remains of a single volcanic plug or neck. There is no other volcano in New York. But not this fact alone answered the inquiries of the geologist. It was found that the lava plug lay in between the masses or layers of the Hudson River shale, that its prominence in the landscape was due to the erosion of the shale from about it, but where the lava came from, whether it came up through this ancient early Siluric shale here, a time at which we know of no volcanic activity in this part of the country, or whether it was of later date, were questions which perhaps are not even yet determined but which nevertheless have called for many examinations and conferences of geologists at the spot, many diagnoses of the case after close examination of all the conditions in which the volcano is involved. Geologists who can speak from most intimate acquaintance of the rock and its surroundings are disposed to believe that this volcanic plug did not come up through the rocks at this place. The country is one of great disturbance in its rock structure. It lies in the heart of mountain folds of an ancient type and right here these overturned mountain folds with their thrust faults or planes along which the top of the fold has been shoved over their lower part are very clearly manifested. The

great thrust plane is evident in Bald mountain, just across the river from where this volcano lies. All these folds have been thrust from the east westward. There is, then, the large possibility that this volcanic plug has been cut across by such a thrust fault and has been transported from its original place eastward on the thrusted portion of the fold. If this is true, the rest of the plug is somewhere to the east, perhaps over the state line in Vermont, buried out of present view. Thus some geologists think; others conceive that the lava came up where it is during the Devonic period, like the volcanic hills which dot the St Lawrence plain north of the state boundary, and penetrated overlying rocks now worn away. But whatever the truth, the volcano is a problem still of great geological interest and the effort to save it is timely for the attacks upon it have carried off a substantial part of it, though leaving its present exposure most instructive.

THE CLARK RESERVATION

A glacial park

In the course of the operations of the Geological Survey, the study of the water courses resulting from the melting of the great ice sheet brought into prominence the abandoned gorges and cataract cliffs of the great east and west glacial streams which cut through the rock beds of the Helderberg plateau in the region lying to the southeast of Syracuse and both east and west of the village of Jamesville. These great streams were made while the ice was extending, in retreat, over the basin of Lake Ontario and the valley of the St Lawrence river, and the discharge of these streams was from the west toward the east along the commanding front of the ice sheet and out into the Mohawk-Hudson drainage. The present drainage of this region is by streams which flow from south to north and the old abandoned waterways transect these existing drainage features.

The features presented in this region are extraordinary in more than one sense. They are highly picturesque and their record is that of a great body of flowing water larger than Niagara which made one cataract at least of horse-shoe shape higher than the Horseshoe Falls of Niagara, and the whole strip of country is dotted with the abandoned plunge-basins of subsidiary falls with potholes and the rocky ravines of contributory gorges.

Most conspicuous among these abandoned escarpments is that which surrounds the Jamesville lake and over which a cataract

plunged into the lake basin beneath, originally the plunge-basin of the lost river. This lake and others of less size have been commonly known in the vicinity as the "Green Lakes." They reach extraordinary depths for such little water bodies and their water, seldom stirred by storms, is of wonderful clearness, and on days when the skies are blue have a deep emerald green color.

The Jamesville lake, whose water surface covers about nine acres, with its horse-shoe cataract cliff, the smaller "dry lake" to the west, their connecting rock channels and adjoining potholes, have recently been acquired by the State Museum, through the generosity of a private citizen, in order to preserve its extraordinary features from invasion. Unfortunately for the sentiment which attaches to places of this kind and their high educational value, the present increase in the demand for cement and cement rock constituted an immediate menace, and the splendid amphitheaters among these rocks afford a particularly inviting point of attack for such enterprises. Happily for the people of the State, for posterity and for the better sentiment of the community, the appreciative interest of Mrs Frederick Ferris Thompson has prevented the threatened destruction. Mrs Thompson has acquired an area covering about one hundred fifteen acres of land and taking in parts of several farm properties and has made this property over to the Regents of the University as a geological exhibit of the State Museum, giving it without restraint as a memorial of her father, former Governor Myron H. Clark, whose name it is to bear: The Clark Reservation.

The geological history of the place is one of much fascination, and while people were wondering whence these mysterious bodies of water came — these deep, funnel-shaped lakes without inlets or outlets — and what agencies could have caused the singular gorges and majestic amphitheaters, some thinking that they were the abandoned and water-filled craters of old volcanoes, others that these strange caverns were produced by the sinking of the rock beds or the solution of the limestone strata or of the salt beds which lie beneath them, the suggestion as to their true nature seems to have been originally made by Mr G. K. Gilbert. Subsequently Prof. E. C. Quereau, while located at Syracuse University, gave with some detail and illustration the approximate solution of their origin and history. Later in the more protracted and detailed work of the Geological Survey, the portrayal of these east and west channels and their great significance to the geological history of the State has been on many occasions demonstrated by Prof. H. L. Fairchild.

CATARACT BASIN. JAMESVILLE LAKE

View looking across amphitheater from south crest. The height of this escarpment is about 180 feet

JAMESVILLE LAKE. ANCIENT CATARACT

Looking northwest, into the amphitheater

STREAM EROSION IN LIMESTONE

On south crest of Jamesville cataract. Looking northeast

CLARK RESERVATION

The lake, looking southeast

CLARK RESERVATION

One of the caves in the face of the cliff wall

CLARK RESERVATION

Hermit's causeway, or pathway under the face of the cataract cliff

CLARK RESERVATION

The colosseum or the cliff of the " dry lake," 200 yards west of the lake

It is not alone the geological features of the place that are of interest. To the lovers of the wild plants they have long been famous, for in the steep, wooded talus at the foot of the amphitheaters, in the neighboring ravines and potholes and bare rock surfaces, there have been found more rare ferns than in any other part of the State. The State Botanist says that more than forty species of these ferns grow about and within a few hundred feet of one of the Green Lakes — a record unknown from any other locality in the temperate zone outside of California, and one that it is possible to equal only in some tropical or subtropical countries. The flowering plants are present here, too, in a profusion that is not surpassed by the fern life, and among them are many rarely found elsewhere.

LOGAN PARK

Logan Park is situated in the village of Percé on the open gulf coast of Gaspé in the province of Quebec. It was established there to commemorate the service to geologic science through a long life, of Sir William Edmond Logan, founder of the Geological Survey of Canada, who began his official work at this spot. As to the first measures taken to establish this geological park, I may quote the following from the *Comptes Rendus* of the Twelfth International Geological Congress held at Toronto, 1913:

> L'idée d'ériger à ce moment quelque souvenir convenable à la mémoire de Logan a été suscitée par le Dr John M. Clarke d'Albany, qui, sur l'invitation spéciale du Dr George M. Dawson, avait été chargé de l'étude des formations géologiques de la Péninsule de Gaspé. Dès le début de ces examens, le Dr Clarke apprit à apprécier le travail géologique de Logan sur ce terrain vierge et à se fier à l'exactitude de la majeure partie de ses conclusions. La proposition courtoise et opportune du Dr Clarke qui était accompagnée d'une souscription très importante fut immédiatement adoptée par le comité exécutif, qui nomma un sous-comité spécial composé de MM. A. E. Barlow, président, W. G. Miller, R. W. Brock et A. P. Coleman qui furent à même, grâce aux souscriptions généreuses des géologues canadiens, de mener à bonne fin le projet.

In accordance with the action indicated subscriptions were raised to an amount necessary to provide a suitable bronze commemorative tablet, which was executed from an effective design by M. Henri Hébert and was affixed to the wall of a striking boss of limestone which rises in the very heart of the village. At the time the tablet was cast it was decided by the committee in charge to make a duplicate and because of the geographical remoteness of Percé

this copy has been affixed to a glacial boulder placed in front of the Victoria Memorial Museum at Ottawa.

After the dedication of the Logan memorial at Percé, the rock to which it was attached and the entire plot of land surrounding this rock were freely presented to the Logan Memorial committee as a public park by the owners of the property, Robin, Jones and Whitman, Ltd. (formerly the Charles Robin Co.) through the active and courteous intervention of Messrs John LeMarquand of Percé and William F. Hamon of Paspebiac, for the company. In response to this generous act the committee agreed to put the property in good order and to maintain it in accordance with the terms of the gift. In due course the property has been transferred to the Crown in the trusteeship of the federal Department of Mines.

The writer was asked by the committee to take all charge of the placing of the memorial, the preliminaries in the acquisition and transfer of the property and the plans and expenditures for the improvement of the plot. The lamented Dr A. E. Barlow, distinguished geologist and chairman of the Logan Memorial committee, the day before he sailed on the ill-starred "Empress of Ireland," transferred to the writer a sum of money raised by his committee to be expended as indicated. With this the park has been carefully cleaned of debris, inclosed by an iron fence with gates both at the main road at the lower end and at the adjoining property on the upper end of the plot, with a walk connecting the two gateways. In the protected corners of the park, Jersey willows have been set out, in the hope that there is protection enough in the lee from the salt winds to let them grow.

The geologic interest of this place lies first in the rock to which the memorial is attached — a projecting vertical ledge of Ordovic or Cambric "edge-on" limestone conglomerate whose sharp contours are rounded by weather and whose broad back is softened by gray and yellow mosses. This rock pierces the sloping surface of the hill in such a way that at the upper end one can mount the summit from the level, while at the bottom where the tablet is placed the rock face rises 30 feet in the air. The surroundings of this little memorial spot are most beautiful. On one side rises the high, sheer, deep red rock face of Mt Ste Anne to an elevation of 1200 feet, while right and left are the sea cliffs with insinuating curves suggestive of the engrossing geologic problems they contain. Above the park and beyond the cliff which hides it from the sea

stands the majestic Isle Percée, the Pierced Rock, most glorious natural feature on all the eastern seaboard.

Thus embrasured amid geologic scenery whose secrets were first unloosed by Logan, the park serves well to keep alive the memory of a great geologist. Logan, born in Montreal in 1798, trained in Scotland and Wales, returned to America in 1837 to study the coals of Nova Scotia and Pennsylvania. Seeing the great possibilities of geological development in Canada, he conceived and executed a purpose to organize an official survey of the public domain, as it then was. This organization became effective in 1841 and he, as its chief, suspecting there was coal to be found in the rocks of Gaspé, began his first season's work on this coast. Instead of finding coal he discovered an amazing series of Paleozoic rocks, similar in character to and an actual extension of those which had just been described by the geologists of the New York Survey in their annual reports from 1837 to 1841. His very first work thus established a common bond between Gaspé and New York which has been and is to be eternal. Similar scientific concerns brought Logan into intimate relations with Hall, the great geologist of New York, and the two men joined hands in many scientific enterprises. It is fitting therefore that New York should join in his memorial.

The Logan memorial was unveiled July, 1913 in the presence of nearly a hundred geologists from all nations of the world brought together by the International Congress, and on this occasion brief addresses were made by Dr A. E. Barlow for the committee, Charles Lamb, Esq., mayor of the town, and by the writer.

THE HUGH MILLER CLIFFS

On the Quebec coast of the Bay Chaleur, just where the broad waters of the Ristigouche river discharge into it, is Scaumenac bay, a long arc of shore bounded at its eastern end by Pointe-a-la-Garde (whose name commemorates the last fight of the " Conquest," 1760), and at its western by Magouasha point. Midway in this arc at the mouth of the Scaumenac river, projects Fleurant point, and from Fleurant point to Magouasha point rise the rock cliffs which have in later years become so celebrated in geology as the depositary of infinite remains of fishes of the " Old Red Sandstone."

Nowhere in the world are these singular fishes so amazingly abundant or so remarkably preserved, and the Scaumenac rocks have become celebrated afar for their wealth of this ancient life. These creatures are like the " Old Red Sandstone " fishes that Hugh Miller portrayed on the pages of his remarkable books,

"The Old Red Sandstone," "Testimony of the Rocks," "Footprints of the Creator," and which he used as weapons to belabor the growing ideas of transmutation and evolution. Hugh Miller was a great Scot; he gave to his generation of three-fourths of a century ago the first lucid account of these Old Red Sandstone creatures, but not only that; he wrote inviting books, not always of science, but always clothed in vigorous and effective diction; he fought for a freedom of thought and action in civic and ecclesiastical affairs. But most of all he remains a great and inspiring lover of the rocks whose influence spread far afield through the English-speaking world.

These cliffs on Scaumenac bay are to bear his name and serve as his memorial in a country which he never saw but over whose foundation stones he labored well. The Hugh Miller Cliffs have, at the writer's suggestion, been thus formally and officially designated by the *Commission de Géographie de Québec* (Bulletin 9:86, 1915).

BIRD NESTING-PLACES ON PERCÉ ROCK, BONAVENTURE ISLAND AND THE BIRD ROCKS OF THE MAGDALEN ISLANDS

As the earnest of an interest which can recognize no political boundaries but is founded in the broad concern for the preservation of nature's works, reference may be here made with propriety to the efforts toward the official establishment of bird sanctuaries on the islands of the Gulf of St Lawrence. As a part of the activities of the Director it is not inappropriate that record be made of these efforts.

There was a time not far back in our history when many of the islands of the Gulf of St Lawrence and the Quebec Labrador were nesting places of clouds of sea fowl, preeminent among which in beauty and abundance was the Gannet or Solan goose. The early navigators of the gulf saw and in their relations made record of these great bird colonies, in terms of astonishment and wonder that such myriads of birds could find room even to congregate on such insulated fragments of land.

But no sooner were these colonies discovered than they and their eggs became the prey of sailor and fisherman and their very contact with humanity has brought about their impending demolition. All the world knows the fate of the Great auk, the first member of these colonies to be totally extinguished by the hand of man. Audubon, three-fourths of a century ago, seeing the destruction going on among them by the ruthless robbing of nests at all these spots, cried out against it and foresaw extinction for all these races.

Then it was the Gloucester fisherman and "egger" who was carrying away the eggs by the hundreds of thousands every year, to be sold in the Boston and New York markets. Such vandal procedures lessened in extent as the Gloucestermen left these waters but the lessened possibilities of reproduction have nevertheless vacated all the islands and cliffs in the St Lawrence of these birds except for the colonies named above.

Of these three populated islands two have the same coterie of bird citizens: the Bird Rocks of the Magdalens, in the heart of the gulf, and Bonaventure island, 3 miles off the Gaspé coast at Percé. In them both the Gannet predominates; and with this beautiful bird are associated the Kittiwake, Guillemot and Murre, the Razorbill auk and the diminutive Puffin; a venerable association from which only the Great auk is missing. The Bird Rocks colony is on the ledges of a most isolated solitude in the very heart of the gulf, and yet this fact has not protected its population from decimation. Lovers of bird life who have studied the spot estimate its present census as not above 15,000 for all birds and it is more than doubtful if the Gannet constitutes one-half of this number. The stories of the old days led the reader to believe that the birds were without number and it is evident that in Audubon's day the number was many times greater than now.

The colony on Bonaventure island has, on the other hand, obviously grown in the number of its gannets within the writer's personal acquaintance with it during the past ten years or more. Today the Gannet colony of Bonaventure island is the largest in America. It is lodged on the seaward steep ledges of the island but while its cliffs are steep and difficult of access, its nearness to the mainland with latter day conveniences of motor boat travel menaces its integrity and every season the cliffs are befouled with the brutal destruction of the birds by the tourist, the fool with a gun who can not be restrained from shooting into the beautiful array upon the cliffs merely to see how many birds he can kill.

The Percé rock at Percé presents a different bird colony composed of only two elements, the Herring gull and the Crested cormorant. It is needless to describe the majesty and wondrous beauty of this great insulated stock; its features are without parallel. On its summit only, nest these two species of birds, close to the habitations of men, and growing fewer in number because of it.

The issue (long hoped for by many friends of these relict colonies) as to whether these birds were to have the protecting arm of government thrown about them, through passage of some penal-

izing prohibition or by withdrawing the nesting places into public reserves or sanctuaries, was brought into active prominence in the winter of 1913–14 by an official order condemning to destruction the Cormorant colony on the Percé rock because of its alleged sin in devouring the fry of the salmon. This allegation of offense was based upon assumption — the act has never yet been proved and indeed recent examination of these very Percé cormorants by Mr Taverner has, he tells me, disproved the accusation in all the birds (some thirty) which have come under his dissecting knife.

That the writer interested himself in the first efforts made to claim the innocence of this grievous allegation against birds whom nature made to live on fish, is less to the point than the fact that after having urged the arguments for protection as best he could in quarters of influence, he responded to an invitation from the Commission of Conservation of the Dominion of Canada to present a plea for the protection of these notable spots, and the address given on that occasion follows:

Protection of the sea fowl of the Gulf of St Lawrence

The matter before our minds at this time is so wholly grounded in sentiment that it may seem of diminutive importance in the face of an overwhelming human issue. Whatever may be the turmoil abroad in the world, it can not change the fact that the attitude of government toward the protection of its natural resources is an index of its best attainment. This is all the more true of an assumption which presents no possibilities of a commercial or material benefit. We recognize the fundamental proposition that the government which does not early see the importance of restraint from overindulgence in the bounties of nature and its seemingly inexhaustible possibility of wealth, is negligent and even suicidal. Time teaches the necessity of such restraint with the visible, and practical economy soon develops the imperative demand for uncovering the invisible, resources of the earth. The impetus to make a country yield its full flower and fruit in every direction with which nature has endowed it, has been productive of the finest scientific efforts which civilization has wrought out.

Now, however, is a different proposition: to save to the world certain species and groups of waterfowl, now traveling the rapid road to extinction. If they are not saved, who can say the world is poorer in a material or commercial sense? If they are saved, protected and allowed to propagate and keep possession of their ancient domain, who can say that the world is in any wise materially the richer? The birds that frequent the remarkable breeding places in the Gulf of St Lawrence — the venerable Bird rock, the most ancient monument of Canadian history, the cliffs of Bonaventure island and the dramatic Percé rock — are no special profit to

material concerns of humanity; no one can eat them, their eggs are no longer of moment as a source of food supply; and, indeed, some of the members of these remarkable colonies are under present indictment of living too freely on the young fry of the salmon streams; thus, it is alleged, invading human happiness.

The races of these birds are on that easy road that leads to destruction. The appeal, then, if they are to be saved, must be to the trained sentiment which deprecates and mourns the destruction from off the earth of any of nature's creations; which, as one might say, gets the proper angle and apprehends their significance in the great scheme of life. In every civilized community there is a large, a very rapidly growing and perfectly comprehensible sentiment that would protest against a needless and an entirely avoidable destruction or waste of these products of creation. Such a sentiment is a natural emotion; it springs both from a sympathy inborn with our aboriginal state and from an acquired appreciation of the ages of labor and experiment on the part of nature in trying out her methods and her products until these ends have been reached — ends, indeed, which, though seeming final, may actually be mere passing stages on to something better.

In a young country as large as ours where population and settlement have been making a hard fight against the embarrassments of the wilderness, it is natural that immigrants and invaders should have shown a disregard of native life in so far as it fails to contribute to human comfort; but the fact is an open one that the more dense the population, the more highly cultivated the state of the land, the greater becomes the abundance of wild life — a fact evident throughout European countries where, in the midst of a thick population, native races of birds, beasts and fishes are preserved in probably greater abundance and variety than even in new lands like this.

Our course here toward our native races of birds has been historically incorrect until these later years. We have already permitted the total extinction of some of our native birds and the reduction of others to such scattered remnants that extinction at an early date seems unavoidable unless the arm of the law can reach farther than it is now doing.

We have suffered serious permanent losses from our American bird fauna. From the islands of the Gulf of St Lawrence, first and foremost, the Great auk and the Labrador duck. Today the Passenger pigeon, once, as we all know, so tremendously abundant in this country and such an obstruction to the ordinary operations of the struggling farmers as (it is reported by Lahontan) to call forth the excommunication of the bishops, is gone. The Wild turkey, sacred to the Puritan harvest feast, is exterminated from Canada; the Whooping crane, the Trumpeter swan, the Golden plover, the Hudsonian godwit, are all nearly extinct; the Willet and the Dowitcher are on the same declining path.

Now, so far as our birds contribute to the protection of our commercial assets, in so far as they prevent by many millions of

dollars in annual value the destruction of our agricultural crops, our forest and shade trees through the incursions of noxious insects, just in so far there is an imperative reason why they should be safeguarded by every restraint within the power of the people. No argument is needed and no defense is required for the much talked of "restriction of personal liberty" in the destruction of insect-eating birds. We have reached and passed that point. Nothing can so irrevocably restrict personal liberty to hunt and shoot as the entire destruction of game, and this very selfish consideration alone is efficient in the execution of the protective laws; and yet it is questionable whether our restrictive measures have been taken in time to be fully effective.

There is a fundamental principle here upon which the effectiveness of game laws and general protective methods must be estimated, and it is the sole criterion by which we can be guided. No system of protection can be efficient if under it the native birds or animals are still diminishing from year to year. Such a condition would be of itself proof that we are destroying more than the annual increase and using up both interest and capital; and it is to my mind an open question whether our present laws have up to this time been effective in this regard. So much they have effected, that the falling off of the native races is less rapid, but there is an actual annual diminution, even though in some instances small, and progressive diminution spells extinction. I can not undertake to speak of the relative merits of general laws of protection, but incidentally may observe that in my own state the inefficiency of the general protective laws outstanding for some years past has led to later very severe and stringent regulations in virtue of which it has become an offense to destroy any of the native races of birds, with discriminations against an exceedingly small number regarded as reckless in their disregard of agricultural and fishing interests. I refer to this law without any special reference to open and close game seasons. But I would like to say another word regarding the existing system of protective laws in respect to its failing to meet the requirements of adequate bird protection. If we can not through the laws sufficiently reduce the destructive agencies acting upon species which are actually vanishing, particularly a considerable number of our game species whose fate now hangs in the balance; if we can not instil into the pot-hunter, the resident or citizen foreign to our mode of thought and our high purposes, of the man out of the reach of observation, who thinks to deceive others while indulging himself; if we can not make the executive effect of our laws reach into those remote corners where these native races are propagating, we must turn to, and by the encouragement of a proper spirit and sentiment amongst our citizenry, where the law itself can not much help or hinder, encourage, not merely actual respect and regard for these races but active interest in their preservation by the erection and protection of places which are to be totally exempted from a hunter's privileges. Preserves, reservations, bird sanctuaries, places of refuge where such security can

be afforded, become more and more a necessity as the remoter regions of our land become more readily accessible and more fully settled.

Our governments, yours and mine, in the splendid national parks which have been set apart, have furnished almost ideal conditions for the safe reproduction of the species of birds that naturally inhabit them, but these are great parks and from their size and cost of maintenance must always be too few in number sufficiently to supplement other means of protection. We find growing up about us in the wholesome development of public sentiment on this matter of protection, private refuges for bird and beast, and I count it among these wholesome developments of our civilization that these reserved spots on this estate, on that private domain, a breeding place near some municipality taken in charge by some private organization; that such refuges as these are increasing; and I find, too, in such a proposition as has been brought to the attention of the Province of Quebec by Colonel Wood regarding the sanctuaries or refuges for the native races of animals in the Quebec Labrador, a fine expression of the earnest desire and purpose of the lover of nature to protect the works of nature.

Now it is needless for me to say that small areas taken at random can accomplish much toward the preservation of our natural bird species. To be effective, a small reservation must be located at some point to which the failing species themselves have made resort for the especial attractions and facilities the places offer for their multiplication, and this brings us immediately to the consideration of the islands of the Gulf of St Lawrence and their bird colonies.

Time was in the early days when all the islands off the coast of the gulf and in the gulf and off the coast of the Labrador, were to our Atlantic coast what the islands of the Hebrides, Saint Kilda, Ailsa Craig on the west and Bass rock on the east of Scotland, the Skelligs off Kerry, and its neighbors off Devonshire, all these islands with their wondrous colonies of these very birds with which our attention is now concerned, have been to Britain.

The present condition of the Gulf of St Lawrence nesting places

The Bird rocks

These islands, constituting the northernmost member of the Magdalen islands group, belonging to the county of Gaspé and lying 120 miles out in the gulf, consist of three isolated rock masses, the first or the Great Bird, covering about 7 acres, and the Lesser Birds, which are two bare rock masses, lying close at hand on the west and being little more than rock reefs. The Great Bird has no human population except the lightkeeper and his attendants. The bird colony here consists of several species of waterfowl of which the Gannet or Solan goose is preponderant, the others being the Razorbill auk, the Puffin, the murres and the Kittiwake.

In the days of the early settlements, this "Isle-aux-Margaulx," as it was called by Cartier, housed an enormous and numberless

colony. When Audubon visited the place in 1833 he found and made record of what was not generally known at the time, that the attacks of the eggers upon the Gannet nests here and elsewhere, particularly on the Labrador coast, were confiscating some hundreds of thousands of eggs annually which were sold in the New York and Boston markets. These attacks have undoubtedly been the cause of the extinction of the Gannet roosts on the islands and coasts of the Labrador, on Perroquet island and on the Grand Manan. Since the establishment of the light on the Bird Rock the attacks of the eggers on this colony have diminished, but the colony has been and is yet exposed to the demands of the fishermen for eggs and to the incidental killing of the birds.

The history of this bird colony has been fairly summarized in the recent publication, "The Gannet," by J. H. Gurney, F.Z.S. (London 1913), and the statement there incorporated in regard to the census of the colony ten years ago, quoted from observations made by Mr A. C. Bent, would make the total of the colony about 10,000 birds, of which there were

Gannets	2500
Kittiwakes	2000
Razorbills	1800
Brunnich murres	1600
Murres	1400
Ring murres	100
Puffins	600

My visits to this colony have been of more recent date, 1910–11, and without attempting to make an estimate of the total population, I believe that the Gannet element in the colony is larger than above intimated and that the total census of the birds would probably not fall below 15,000. In my judgment, the colony is not at the present time decreasing and I think this is due largely to the comparatively few visits being made in these latter days to these islands by collectors of birds and of birds' eggs.

Protection. The greater Bird Rock with its adjoining islands being Crown land, guardianship could, in my judgment, be most efficiently accomplished by assigning that duty to the inspector of fisheries on the Gaspé coast, Commander William Wakeham. Commander Wakeham having a cruiser at his disposal is more frequently in the Magdalen islands than any other official of the government. Having supervisory functions, he could, with the aid of the lightkeeper as guardian on the ground, exercise a forcible supervision and protection of the place.

Bonaventure Island

The bird colony on Bonaventure island has the same constitution as that on the Bird Rock. This island lies 3 miles off the coast from the village of Percé; it is private property and its area of about 6 square miles is practically held in fee by the present occupants, among which is one of the oldest fishing establishments on the gulf.

During the past summer, at the instance of the Natural History Survey, Mr P. A. Taverner, with his assistants, made a special study of this colony, the breeding habits of the birds, and endeavored to make an approximate count of the number of birds there living. Again the Gannet is paramount in numbers, and I believe I am correct in stating Mr Taverner's judgment, subject to reservation and correction, that the Gannet population on the island is approximately between 7000 and 8000. This is a very much larger number than is assigned to the gannets of the Bird Rock colony and intimates that the Bonaventure colony as a whole (assuming that there is approximately the same numerical relation amongst the other species there nesting) is by very much the largest colony of these waterfowl in the gulf, and hence on the Atlantic coast of North America.

This colony finds its nesting places on the vertical eastern ledges of Bonaventure island, which rise sheer to a height of about 400 feet, and they stretch over a length of about a mile and a quarter. They are well protected from above, but now that the day of the motor boat has arrived, they are bare and exposed from below, and the destruction which has been inflicted upon them of late years by "the fool with a gun" has been appalling. This statement will, I believe, be verified by the investigations and reports of Mr Taverner.

The protection of this very remarkable, if not altogether unique nesting place, presents some provisional obstacles in the way of administration. I have secured from the property owners a provisional promise to deed the ends of their lots bounding the bird ledges in exchange for the construction of a fence near the edge of the cliff which would prevent their sheep and cattle from falling over. I am prepared to assure the erection of this fence, but the proper administration of this property thus deeded for a specific purpose and the maintenance of a warden are matters still open for determination. If it lies within the powers of the Division of Parks to assume protection of these bird ledges as such, without incursion upon the property rights of the owners of the land, such action would, in my judgment, be the simplest solution of what has appeared to me a somewhat complicated problem.

Because of the accessibility of this colony, its great and apparently increasing size, it is now recognized as one of the wonders of the gulf coast and is daily visited during the tourist season; all of which facts seem to demand early and vigilant action for its protection.

Percé rock

Percé rock, off the village of Percé, constituting the most dramatic scenic feature on all the Atlantic coast, is the abode of a colony composed of two species, namely, the Herring gull and the Crested cormorant. This ancient and venerable assemblage has been here since the beginnings of human history on the coast, and the upper

surface of this rock has never, so far as records show, been the breeding place of any other species.

A year ago an indictment was brought against the cormorants of this colony, accusing them of destroying the young fry of the salmon in the many salmon streams of the mainland adjoining. The indictment was followed by an order, subsequently suspended, to destroy the cormorant colony.

The investigations of ornithologists have failed to prove that the Cormorant feeds specially on the young of the salmon. After somewhat diligent inquiry of authoritative sources, I have failed to find any ornithologist who would say that this accusation has been proved, and I think I may take the liberty of saying that the investigations of Mr Taverner are not confirmatory of the indictment.

Percé rock, for its unique beauty, for its extraordinary scientific interest, and for its bird colony, presents strong claims for reservation. The fishermen along the coast do not regard these birds as their enemies. They help themselves, now and again, it is true, to the contents of the herring nets, but where herrings occur in untold millions and the birds were created with a necessity for fish food, the damage to human interests through these agencies is certainly negligible and the birds are so intimate a part of the human interests of the countryside, that I may express with confidence the feeling of the fishermen as wholly in their favor. Yet, this colony is exposed to constant attacks, for the young gull, a favorite viand with the fishermen, when on the beaches still unable to fly falls an easy victim to their attacks.

Protection of the Bonaventure and Percé rock colonies. In presenting the claims of these bird colonies to your consideration, it seems proper that I should recommend also to your notice a practicable procedure concerning their guardianship. A single warden is all that will be required for this purpose, and there lives on Bonaventure island a descendant of the original owner of the island, whose interest in these birds is very keen. He is daily back and forth from the island to the mainland, is known to me to be faithful and trustworthy and efficient, and he is by all means the best man to act in the capacity of warden of these two nesting places during the months of the presence of the birds, from April to October inclusive.

BOARD OF GEOGRAPHIC NAMES

DECISIONS

BEACON. In the matter of the application of the Central New England Railway Company for the change of the name of the station *Fishkill Landing* to *Beacon.*

Decision. In view of the erection of the villages of Fishkill Landing and Matteawan into the city of Beacon, the Central New England Railway Company is authorized to change the name of its station *Fishkill Landing* to *Beacon.*

ERITOWN. In the matter of the application of the New York Central and Hudson River Railroad Company for the change of name of *Erieville,* Madison county, to *Eritown.* This application was accompanied by a petition of citizens.

Decision. In view of the confusion arising from similarity in the names of Erieville and Earlville on the same (Chenango) branch of the West Shore Railroad, and for the additional reason that the proposed term *Eritown* embodies the christian name of Eri Richardson, one of the first settlers of the place, the desired change is approved.

LINDA. Communication from United States Geographic Board recommends the use of the name *Linda* for an island in the St Lawrence river about 2½ miles northwest of St Lawrence village, Cape Vincent township, Jefferson county, sometimes called Britton's island.

Recommendation approved.

MOSHIER. The United States Geographic Board recommends the name *Moshier* for certain ponds in the town of Webb, Herkimer county, in preference to *Mosher, Mosier* or *Moshiers.*

In view of the fact that *Moshier* is the correct spelling of the surname of the guide for whom these ponds are named, the recommendation was approved.

NISKAYUNA POOL. Communications received from Willis T. Hanson, sr and E. W. Rice, jr, Schenectady, N. Y., requested the change of the name *Peck lake* to *Niskayuna lake. Peck lake* is a name which had been applied to the sheet of water formed by the closing of the barge canal dam at Visscher Ferry. It appeared that the canal officials gave this name probably in recognition of one of their superior officers. The remonstrances made by the gentlemen named were based on the ground that the name is neither euphonious nor carries any association of local interest. Subsequently the trustees of the Schenectady County Historical Society passed a resolution appointing a committee for the pur-

pose of urging that this body of water be given the name *Niskayuna* or some other appropriate historic name.

Decision. It was the view of the Board that the term "lake" should not be applied to such artificial bodies of water, but that in view of their character a better procedure would be to apply to them the designation of "pool," and the employment of the term *Niskayuna pool* was recommended in place of *Peck lake.*

RAILROAD MILLS. A petition signed by a number of citizens in the vicinity of the railroad station known as *Railroad Mills,* situated on the Auburn branch of the New York Central Railroad, requested the change of this name to *Glendale* or *Wildwood.* These names were disapproved by the board as being both inappropriate and commonplace. Meanwhile, as it appeared from a personal examination made by one of the members of the board that Railroad Mills is merely a road crossing and flag station with no post office or settlement attached, and that the present name has stood for a half century and serves the purpose of a local designation, and further that the request was based upon a desire of the land owners in the vicinity to effect the train service at this place, it was regarded by the board that the request was not serious and no action was taken.

AURELIUS. The following correspondence has passed with regard to the change of the name of *Aurelius* to *Relius* by the officials of the New York Central Railroad:

> The State Board of Geographic Names desires the cooperation of your road in restoring to its proper form the name of *Aurelius,* on the Auburn branch, which now appears in your time tables as *Relius.*
>
> As you are aware, Aurelius is one of the many names taken from Greek and Roman geography and biography that were imposed upon New York by the land offices of the early days. These names have now been standing so long — all of them for over a century — that they have become a part of the political geography of New York and have established their right to remain. The mutilation of the name Aurelius has doubtless resulted from an easy shortening of the term which would have remained entirely local had it not received the approbation of your road by the spelling adopted in your time tables. As you may remember, the first departure from the correct usage appeared in your time table under the form of *'Relius,* the apostrophe thus indicating the decapitation of the word.
>
> The State Board of Geographic Names regrets and deprecates such a mutilation of the venerable place name and as nothing is accomplished by its adoption, no business facilitated, no convenience afforded, we desire to reinstate the name in its proper and original form.

An excerpt from the reply to this communication follows:

> From an operating standpoint there is serious objection to changing the name of Relius back to Aurelius. This name was changed to Relius some few years ago on account of the possibility of operators, conductors and enginemen making errors in the handling of train orders, the first two letters of the words Auburn and Aurelius being the same.
>
> It is for this reason that the name of Marcellus, another good old name, was changed to Martisco at the same time on account of the possibility of this name being confused with Camillus.

From the above correspondence the attitude of the New York Central Railroad toward the mutilation of the place names along its lines is made a matter of record.

SWASTIKA. The attention of the board having been brought to the establishment of a post office in Clinton county under this name, subsequent to the date of the enactment of the law governing the board, inquiry was made of the fourth assistant postmaster general regarding the procedure in this case, and as the reply received did not afford any explanation of the matter in question, a communication was sent to the postmaster at "Swastika" communicating a copy of the law and advising him of the necessary procedure in the change and establishment of such names, in reply to which, in due course, a petition was submitted to the board, signed by a considerable number of residents of Black Brook, Clinton county, asking that the change of *Black Brook* to *Swastika* be approved by the board.

Decision. On the ground, first, that the term "Swastika" has no appropriate association with or significance in the history or geography of New York, the board disapproved the proposed change and filed a copy of its disapproval with the fourth assistant postmaster general. A subsequent communication from the petitioners expressed a preference fór the name "Balsamdale," which was approved by the board.

It is a matter of interesting record that the United States Department of the Postmaster General has declined to recognize the ruling of the board, as the post office was continued under the name of *Swastika*. Correspondence in regard to this matter was closed by a communication from the secretary of the board to the county clerk of Clinton county calling his attention to the fact that the name *Swastika* had not been established in accordance with the requirements of the New York State statute and that *Balsamdale* was the statutory name of the place and that the citizens should be advised of the propriety of petitioning the Postmaster General to substitute the legal for the illegal name.

IV

REPORT ON THE GEOLOGICAL SURVEY

AREAL GEOLOGY

The past year has again made necessary some shortage of usual activities in the geological survey of the State, which has for its principal objective the completion of the map on the scale of one mile to one inch. The State of New York is very large and a one inch scale map means that field work in representing the distribution of the geological formations and in making proper discriminations of such formations so that its geological history may be easily read, shall be carried out with the closest attention to detail. The topographic or base map of New York is divided into 260 quadrangles, of which number about one-third have been covered by the geological survey up to the present time. This work should unquestionably progress more rapidly, and it will do so when the financial condition of the Department is such that the greater share of the appropriation can be allotted for it. A larger number of expert geologists and very greatly increased facilities for printing are required for the Department surveys in this direction.

The field work on this survey has progressed during the past year in western New York where Mr D. D. Luther has brought to a conclusion his work in the region between Rochester and Buffalo. Mr Luther's reports, not yet published, cover the quadrangles designated as Brockport, Hamlin, Albion, Oak Orchard, Medina and Ridgway.

In northwestern New York Professor Cushing carried to completion the areal mapping of the Brier Hill, Ogdensburg and Red Mills quadrangles. The larger part of the area is occupied by early Paleozoic rocks, and the results on the Precambric rocks were reported a year ago. Some novel details have developed in the Paleozoic rocks.

The Potsdam sandstone continues across the area with much the same character that it has in the Alexandria and Clayton regions farther west. It was laid down on an irregular floor and is thin. The overlying Theresa formation, on the contrary, shows very considerable differences when compared with the same more westerly area. There it was thin, 30 or 40 feet only, and overlaid by an equal thickness of beds which the fossils indicated to be of Tribes Hill age, corresponding to beds in the Mohawk valley regarded as

of lowermost Beekmantown age. On the Brier Hill sheet the Theresa beds thicken and become more sandy, and are followed above by a sandstone, 20 feet thick, and sandy dolomites which carry a large fossil gastropod sparingly. This is, according to Ulrich, a quite distinct formation from the underlying Theresa, and considerably younger, the gastropod indicating an age either very late in the Ozarkic, or very early in the succeeding Beekmantown. The specimens so far found do not suffice for precise identification; but no fossils of the type are known anywhere in rocks as old as the normal Theresa. The zone is, so far as known, a new one in the New York section.

The Tribes Hill formation occurs but sparingly in the district. But a few thin patches of it have been noted on the Brier Hill sheet. Across the Ogdensburg sheet it thickens, but the heavy drift cover there hides all the formation with the exception of two or three scattered outcrops which give no idea of its thickness or importance.

Unconformably overlying these formations, with a very varying thickness of the Tribes Hill underneath, comes a much higher Beekmantown formation which we are proposing to call the Ogdensburg formation, the new name being necessary because both it and the Tribes Hill are of Beekmantown age, and yet are separated by a considerable unconformity. Nearly the entire formation is well shown in the river sections within 2 miles of Ogdensburg. From here the formation runs continuously down the river below Ogdensburg, but the country is so heavily drift covered that outcrops are few and thin and give but little knowledge of the formation. Hence dependence for our knowledge of the formation will have to be chiefly upon these excellent exposures just west of Ogdensburg. Not only are the exposures excellent but the formation is unusually fossiliferous for a Beekmantown formation, and the fossils are unusually well preserved.

The formation consists of thick beds of granular, blue-gray dolomite, alternating with thinner bedded, fine-grained, iron-gray layers. Four or five distinct fossil zones have been recognized; Ulrich has determined the species and correlates the formation with division D of the Beekmantown of the Champlain section. He states that "the fauna of division E is not even suggested, while none of the species are of those which are particularly characteristic of the fossil beds at Fort Cassin."

The Survey has had the services of Professor Chadwick on the Canton quadrangle, next east of the Ogdensburg area, in completion of the work on the crystalline rocks which, during the previous

season, was in charge of Mr Martin. The quadrangles mentioned may be considered now to have been completely covered and the reports thereupon practically ready for publication.

In the central Adirondack region the Blue Mountain quadrangle was surveyed by Prof. W. J. Miller in continuation of work begun the preceding season. There are certain important details registered for this region which may be indicated as follows:

Grenville series. Two extensive belts of Grenville limestone with associated hornblende and pyroxene gneisses have been mapped in the southern half of the quadrangle. One of these occupies the broad valley around Indian Lake village and extends westward up the Cedar River valley for fully 11 miles, and the other reaches from Blue Mountain lake eastward across the quadrangle by way of the Rock River valley, the two belts being joined through the valley south of Rock lake. Smaller areas of similar Grenville rocks occur in the vicinity of Unknown pond and in the vicinity of the Chain lakes. Also a little Grenville gneiss was found in the extreme northeast.

Syenite-granite series. Rocks of this series comprise by far the most of the region. They range from a basic, gabbroic facies to a truly granitic facies. Granite porphyry was found in one small area only. Certain of these rocks show interesting relations, but they still await microscopic examination.

Gabbro. A number of gabbro stocks or dikes of the typical Adirondack sort were discovered in addition to those reported for 1913. At two localities northeast of Long Lake village there are considerable masses of peculiar, light-gray, coarse-grained, basic, igneous-looking rocks which, at the present writing, are still of rather uncertain age and origin.

Diabase. No diabase dikes were located in addition to the two already reported from the shores of Long lake.

Structural features. Though quite variable, the strike of the foliation is in a general way nearly east-west over the quadrangle, the dip in the north usually being southward, and in the south usually being northward.

Three faults only could be definitely located, two across the southeastern portion of the quadrangle and the third already reported as passing through Long Lake.

Glacial and postglacial features. In all, 18 sets of glacial striae have been located. These range from south 20° to 50° west, and are so situated as to prove that the great ice current across the region was southwestward. Well-rounded glacial pebbles of

Potsdam sandstone were occasionally noted at altitudes of from 2500 to 3000 feet.

Certain interesting glacial deposits, extinct lakes, and drainage changes will be fully described in the forthcoming bulletin on the geology of the quadrangle.

In addition to the work above indicated, there are complete or progress reports on the surveys of other quadrangles: Utica, by Burton W. Clark; Mount Marcy, Ausable and Lake Placid, by Prof. J. F. Kemp, who has nearly concluded the work upon the first of these and has the other two well forwarded; and Tarrytown, by Dr Charles P. Berkey. The general geological survey of Long Island has been going forward for a number of years past, on the basis of an agreement with Prof. W. O. Crosby representing the New York City Board of Water Supply. Professor Crosby's final report has been delayed by considerations which seem to have been beyond his control, but it is hoped that this resurvey of an important district of the State may soon be presented for publication.

INDUSTRIAL GEOLOGY

The plan of including a series of economic minerals in the Museum exhibits was mentioned in the report for the preceding year. Within the past season numerous accessions have been received, as set forth specifically in another place, and such progress made that the successful accomplishment of the plan seems assured. It is not the purpose to present a complete series of ores and economic products but more particularly to display those which typify the State's resources and their relations to industry. There is now in hand a substantial collection that embraces typical examples from the more important mining and quarry localities, besides metallurgical and chemical products of local industry and much illustrative matter bearing upon technical methods of extraction and treatment of minerals.

Mines and quarries. The customary review of the mineral industries for the calendar year was prepared and published in the form of a bulletin. The canvass of the various branches revealed an unprecedented activity in production, although in general the conditions could not be characterized as especially favorable owing to rather low prices. The total value of the output, based on crude or first products, was $41,598,399, the largest that has yet been returned to this office and exceeding the aggregate for the preceding year by about 14 per cent. Clay materials, inclusive of brick, terra cotta, pottery etc., represented a value of $12,077,872, which

was little different from the figure reported for 1912. The stone quarries contributed products valued at $6,763,054. Iron ore, with a gross output of 1,606,196 long tons, had a value of $3,870,841, probably the record production for this industry, as was the total returned for the salt industry which amounted to 10,819,521 barrels valued at $2,856,664. The list of products included over twenty other items. The recent progress of the industries, with notes of new developments or discoveries in the field, are set forth briefly in the report.

Report on quarry materials. The first instalment of a detailed investigation of the quarry materials of the State has been made ready for publication so far as the text is concerned, but the illustrations as yet are not all in hand. The present report deals with the crystalline rocks — the granites, gneisses, trap and marbles — which are represented mainly in the older metamorphic regions; the sandstones and nonmetamorphic limestones of the regularly stratified series still await study.

Iron ores of the Highlands. A brief visit to the iron mines of Orange and Putnam counties for the purpose of securing samples of the ores and containing rocks for the Museum collections has afforded opportunity to make some comparative observations in regard to their geological features. These notes are quite general in character, but they are based on the whole series of ore occurrences, inclusive of practically all that have been commercially worked, and on that account may be of interest. The other recent investigations have been of restricted compass, and in fact there has been no attempt hitherto toward a broad geological study of the ores. The recent papers by C. A. Stewart[1] and F. R. Koeberlein[2] upon some of the Putnam county mines embrace about all that has been done in the field during the last twenty years.

The geological formations of the Highlands of Orange and Putnam counties are part of the long Precambric belt that stretches beyond the limits of New York across northern New Jersey and western Connecticut and that in turn is but a part of the larger Appalachian Precambric province. Throughout their extent from southwest to northeast — along the axis of the belt — they undergo no essential changes of character and continue unbroken into the adjoining states. They form knobs and ridges of greater or less

[1] "The Magnetite Belts of Putnam County, N. Y." The School of Mines Quarterly, April 1908.

[2] "The Brewster Iron-Bearing District of New York." Economic Geology, December 1909.

prominence which are capped by the harder silicate rocks, while the larger valleys are floored by limestones and associated schists.

The main elements in the rock series are gneisses. These show considerable variations in mineralogical composition and appearance from place to place but, broadly viewed, are quite uniform as they consist of certain fairly well-defined types which recur throughout the area. There are dark hornblende gneisses in which the hornblende shares importance with the feldspathic minerals and which are further characterized by the common appearance of epidote as a secondary alteration product. As a rule they are of no great extent in any one section, but reappear frequently in belts or bands within the other gneisses. A lighter variety of gneiss carries hornblende or biotite in subordinate amount, consisting mainly of feldspar and quartz in the proportions found in granites. The feldspar consists of both alkali and calcic varieties. The texture is usually fine granular, revealing little as to the antecedents of the gneiss. The commonest type is banded biotite or hornblende gneiss in which the dark components are segregated in parallel bands with lighter material between. The bands are usually thin and quite regular, lending the appearance of a bedded arrangement. This type resembles the characteristic Fordham gneiss of Westchester county which, as suggested by Berkey, probably continues into the Highlands without interruption. All these rocks contain much igneous material in the form of dikes, stringers and other intruded bodies, or that has been absorbed into the mass in disseminated condition, so that often their aspect is quite as much conditioned by this added material as by the original constituents.

The granitic rocks predominate among the igneous class and are made up of ordinary granites with mica or hornblende as dark minerals, of fine-grained aplitic phases, and of coarser textured varieties classed as pegmatite. The normal granites form bosses and stocks of considerable extent and probably of several different periods of intrusion. The latter inference is based on the varied degrees of regional metamorphism which they exhibit; some are practically unchanged from the condition of their first consolidation and others show granulation, recrystallization, or development of characteristic gneissic appearance. It would seem therefore that at least two periods of intrusion are represented and very likely more. Pegmatite is abundant in the vicinity of most of the mines, and in some cases is closely related to the ore occurrence. It occurs in dikes and lenticular masses, often in thin veins interleaving the gneisses in the same way as the finer grained granite. Its almost

invariable presence in one or both walls of the magnetite bodies is a feature that commands attention and that has been remarked also by Spencer in his work in the New Jersey magnetite districts. The pegmatites are only coarser phases of the normal granites and like them probably are of different ages.

Aside from granite local intrusions of syenitic and dioritic rocks occur in the region. At the Croton mine near Brewster the ore is associated with an augite quartz syenite of greenish color, quite analogous to the augite syenites of the Adirondacks. The last series of intrusions is represented by traps, which occur in small dikes and intersect all the crystalline formations.

Crystalline limestone with interbedded graphitic and pyritic quartzites and mica schists is found in belts that parallel those of the gneisses. The series is very similar to the Grenville limestones and schists of the Adirondacks and, like the latter, has been intruded and metamorphosed by the igneous rocks. Such contact phases carry secondary silicate minerals in greater or less abundance.

The present attitude of the formations is monoclinal — the strike being uniformly northeast and southwest and the dip at a high angle, usually to the northwest. Swings of a few degrees occur in the strike from place to place, and both strike and dip are subject to local undulations as shown particularly in the mine workings. Southeasterly dips have been noted at some of the mines. The ore bodies themselves usually show also a pitch by which the longer axis of the pods and lenses as well as of the minor undulations trend downward toward the northeast.

The magnetite deposits are not limited to any one of the formations which have been named nor to any single set of conditions with respect to them, but have various relations, as will be shown. In composition, they range from lean concentrating ores to those of shipping grade carrying from 55 to 65 per cent iron. They include both pyritous and low-sulphur magnetites and are mostly of rather fine grain.

In perhaps the greater number of localities the ore is associated with the banded gneiss and forms a layer or lens within the latter, itself showing a banded arrangement on the borders by alterations of magnetite and the gneiss. The ore bodies conform to the structure of the gneiss in every particular, following even the minor undulations of dip and strike. They are comparatively thin, seldom over 8 or 10 feet across the dip, but on the other hand very persistent along the outcrop and apparently also in depth so far as they have been tested. A feature of their occurrence in many

places is the zone of dark silicates, particularly of hornblende, which intervenes between the ore and the gneiss. These zones are sometimes composed of hornblende alone, a dark green strongly pleochroic variety, but usually contain more or less quartz and feldspar as well as biotite and magnetite. A conspicuous secondary product is epidote which is rarely absent. Pegmatite may take the place of the hornblende zones along the borders, forming the wall for a greater or less distance. The pegmatite is probably of more than one period of intrusion. For the most part it bounds the deposit without cutting or affecting in any way the magnetite; but in a few places there is pegmatite that seems to be later than the ore, as instanced in some Putnam county mines that are mentioned by Stewart in the paper already quoted.

A modification of this type of occurrence is illustrated by those deposits in which pegmatite is in direct contact with the magnetite on one or both walls throughout its extent, although the general country rock is gneiss or mixed gneiss and pegmatite. Under this condition the magnetites are more coarsely textured and lack the layered arrangement characteristic of the bodies bordered by gneiss alone. In the Forest of Dean mine, which is the principal example of this type, the magnetite forms a long pod in contrast with the simple tabular form of the deposits already described. The cross-section of this body is heart-shaped, the two lobes somewhat drawn out and directed upward following the steep dip of the country gneiss. The pitch is 20° northeast. The ore is of shotlike texture and maintains a uniform percentage of iron so as to be practically all of shipping grade. The two lobes are separated by a horse of pegmatitic granite which extends from the surface to the bottom of the workings now 3000 feet on the incline. The same rock is also seen along the border of the main ore mass in many places, and inclusions of it are found in the ore itself. So far as the writer has been able to learn there is no evidence to connect the latter with dike intrusions; rather they appear to be floating masses with the ore.

A third class consists of disseminated magnetites within pegmatitic granite. The ore is a mixture of coarse crystalline magnetite with the ordinary pegmatite minerals and may carry from a few per cent to 40 per cent of iron. These bodies of course have no particular shape or trend of themselves but depend on the local development of the pegmatite mass which may take the form of a lens, a dike or a rounded bosslike body in the gneiss. They are free of pyrite and afford an ore easy to concentrate, although they

are not often very large. They appear to be more common across the line in New Jersey than in the New York Highlands. One mass just south of the town of Warwick can be traced for a long distance but is very irregular, pinching in places to a thin film and again bulging out into a body 100 feet or more across. There seems no reason to regard the magnetite as other than an original constituent of the pegmatite matrix and thus probably of deep-seated origin.

A fourth type, illustrated by a single occurrence to the writer's knowledge, is the Croton deposit in which the magnetite is included within augite syenite. This occurrence has been described in considerable detail by Koeberlein, and the present writer's observations agree with his conclusions. The ore is a mixture of magnetite with the minerals of the syenite which are mainly feldspar and pyroxene, but contains besides more or less quartz, biotite, hornblende, apatite and sulphides. A peculiarity of the ore in this section is the rim of titanite which surrounds the magnetite grains. The magnetite has crystallized after the silicates, in the reverse order of its consolidation in the igneous rocks which have low percentages of the mineral — an anomaly that has been frequently noticed in the disseminated ores of this type. The ore body grades off at the edges into the normal syenite. If the wall rock is igneous, as is indicated by its mineralogy and texture and also by its analogy with the augite syenites of the Adirondacks, the ore is doubtless a magmatic segregation in place.

Another class of deposits differs from all the foregoing in that the limestone forms one of the walls. The ore lies near the contact also with granite or gneiss. The matrix consists of calcite and silicate minerals like pyroxene, amphibole, garnet, chondrodite, chlorite and serpentine. Spinel also may be present. The limestone contact is usually marked by aggregates of the silicate minerals which resemble the skam zones of some of the central Sweden mines. The magnetite is rather fine in grain and on account of the intricate admixture very hard and tough. Analyses show small amounts of manganese. The shape of the ore body is more irregular than that of the deposits in gneiss, only roughly approaching a lenticular or tabular form. The silicate zones evidently are the result of contact influence upon the limestone exerted by igneous masses. The direct agent of metamorphism no doubt is granite or its pegmatite derivative since the rock is always close at hand and of the igneous representatives is the most efficient in producing contact alteration. The best known locality for magnetites of this class is the Tilly Foster mine in Putnam county which has been

repeatedly described so that it has become familiar to students of ore deposits and has been considered almost unique in this part of the country. The writer has found, however, a group of deposits in Orange county, which embody the same features, inclusive of the occurrence of chondrodite, spinel and other contact minerals. This group includes the O'Neill, Forshee and Mount Basha (Mombasha) mines, south of Monroe. In thin sections of the ore from the O'Neill mine both chondrodite and humite were identified. The magnetite is distributed in grains and granular aggregates which often surround the particles of silicates and evidently have crystallized in close relation with them. It seems reasonable to suppose that the iron has been deposited along with the silicates and as a result of the same process, that is by the influence of the heated solutions and vapors given off by the granite magma.

Mineralogy. The principal sources from which the mineral collections of the New York State Museum are derived are as follows:

1 *The Beck collection.* This comprises a considerable portion of the mineralogic material of the State Geological Survey prior to 1842. It was probably the material collected by Dr L. C. Beck for the Report on the Mineralogy of New York.

2 *The Brazilian collection.* This consisted of a small collection of Brazilian minerals and ores, presented in 1865 by the National Museum of Rio de Janeiro, through the Hon. Mr Lisboa, Envoy Extraordinary of Brazil. The present labels on the displayed specimens are inscribed: Presented by Univ. Rio de Janeiro.

3 *The Pickett collection.* This collection consisted principally of fossils but contained some minerals, principally from Lockport and from the New England localities. It was purchased in 1867 from the heirs of the late Professor Pickett of Rochester. The material of this collection is below the grade of the present collections and is poorly represented in the present installation.

4 *The Emmons collection.* This collection was acquired in 1870 through the gift of the Hon. Erastus Corning, who purchased it from the family of the late Dr Ebenezer Emmons. The collection consists largely of crystallized specimens of New York minerals and of foreign occurrences; among the former is a magnificent suite of calcite from the Rossie, N. Y., locality and among the latter a series of specimens from the Hartz, Saxony localities which bear the label of the Freiburg Mining School with the date 1848. The present labels on displayed specimens are inscribed: Presented by Hon. Erastus Corning.

5 *The Simms collection.* A collection consisting principally of gold and silver coins and historical relics, but which included some mineral specimens, was purchased in 1870 from Mr Jeptha Simms of Fort Plain. Few of the mineral specimens in this collection are up to the grade of the present installation.

6 *The Gebhard collection.* This collection was purchased in 1872 from the late John Gebhard, of Schoharie county. The collection, although including some foreign occurrences, was mainly confined to Schoharie county minerals. It is not represented to any considerable degree in the present installation.

7 *The Kunz collections.* These include a fine and extensive general mineral collection purchased from Dr George F. Kunz of New York City in 1886 and a smaller but important collection of minerals from New York City and from Westchester county, N. Y., which was purchased from Doctor Kunz in 1888. The former of these comprises the basis of the present installation of the general mineral collection as well as the bulk of the gem collection. The latter represents a considerable percentage of the present installation of the New York State collection.

8 *The Albany Institute collection.* This collection, which was presented in 1891 by the Albany Institute, includes specimens of great historic value as well as many of intrinsic worth as measured by the standards of the present installation. Among the contributors of specimens to this collection are to be found such names as: Stephen Van Rensselaer, DeWitt Clinton, T. Romeyn Beck, John Gebhard, L. C. Beck, Erastus Corning etc. The present labels on the displayed specimens are inscribed: Presented by the Albany Institute.

9 *The Clark collection.* A small but locally important collection of the minerals of Rondout was presented in 1904 by Mr P. E. Clark of Rondout. The residue of Mr Clark's collection was subsequently purchased the same year and the whole constitutes a suite from which many fine specimens contained in the New York collection have been drawn. A large proportion of these bear the label inscription: Presented by P. E. Clark.

10 *The Nims collection.* This embraces the remainder of the mineral material collected by the late Mr C. D. Nims of Philadelphia, N. Y., which was purchased in 1908 from his son, Mr A. T. Nims of the same place. The Nims collection, while containing some foreign and United States specimens acquired by the elder Nims in exchange, is specially rich in occurrences from northern New York and Canada and notably in those from St Lawrence

county, N. Y. A very appreciable percentage of the present installation of the New York State collection is representative of this material.

11 *The Hodge collection.* This collection was purchased in 1909 from Mr R. S. Hodge of Antwerp, N. Y. It represents the mineral specimens collected by Mr Hodge from the Sterling mine at Antwerp during the many years in which he was superintendent of that mine, and is consequently unquestionably the best representation of the minerals of this famous and unique locality.

12 *The Young collection.* The collection of the late Dr Silas Young of Warwick, N. Y., was purchased in 1914 from Miss Jennie Young of Warwick. The Young collection represents the life efforts of an enthusiastic, accomplished and industrious collector working in the rich field of Orange county, N. Y., and northern New Jersey. The extra local material of the collection also bears witness of the keen appreciation of mineral values which Doctor Young exercised in effecting exchanges.

The present installation of the general mineral collection is made up as follows:

	Per cent
Kunz Collection	54
Young Collection	5
Brazilian Collection	½
Pickett Collection	½
Emmons Collection	2
Albany Institute Collection	2
Gebhard Collection	½
Other sources	35½

The present installation of the New York State mineral collection is made up as follows:

	Per cent
Kunz Collection	13
Beck Collection	10
Emmons Collection	1½
Young Collection	6
Nims Collection	5½
Hodge Collection	3
Clark Collection	3
Pickett Collection	1
Collected by the Mineralogist	11½
Other sources	45½

V

REPORT OF THE STATE BOTANIST

Resignation of Dr Charles Horton Peck, State Botanist. Because of advancing years and impaired health, Doctor Peck has resigned from the scientific service and in accepting his resignation the Regents of the University spread upon their records the following minute:

The service rendered to the State by Charles Horton Peck D.Sc., who has just retired from his position as State Botanist, has been extraordinary in its fidelity, assiduity and productiveness. Doctor Peck entered the staff of the State Museum as botanist in 1867, and from that date to the present his service has been continuous — a period of 48 years. In 1883 the position of State Botanist was created and he has been its only incumbent.

The nearly half century of his scientific activity became an epoch in the science of botany in America, by virtue of the extensive contributions which he made, not alone to the knowledge of the flora of New York but specially through his almost pioneer investigations among the fungi. His researches in this field vastly increased the sum of knowledge and established an orderly and rational classification so that his published papers, issued in the reports of the State Museum, are indispensable to any student of these forms of life. The number of species discovered and described by him are counted by thousands and the additions made through his efforts to the State herbarium are so extensive that this collection of plants is today among the largest on the continent and of great scientific worth. By common consent of his colleagues Doctor Peck has long been recognized as the ultimate authority in mycology — the field of his special labors.

In view of these services whose value to the State can not be briefly estimated or readily expressed, the Regents take this occasion to record, with their regret that the exactions of time have impelled him to retire from the service of the University and the State, their congratulations to Doctor Peck upon a life well rounded and work well done, with their assurance of continued interest and deep regard for his welfare during the years that may remain.

In view of the resignation of Doctor Peck, Doctor Homer D. House has been appointed Acting State Botanist until such time as the Civil Service Commission shall determine the status of the position.

CHARLES HORTON PECK

New York State Botanist 1867–1915

Noteworthy contributions. The most important addition to the State herbarium during the past year is the gift by Prof. Charles S. Sheldon of Oswego, of his entire herbarium, numbering over 14,000 mounted specimens, in addition to a large quantity of duplicates and unmounted material. Professor Sheldon's herbarium contains collections from every state of the union, Canada, Mexico and several European countries. The New York State collections, made chiefly by Professor Sheldon between 1877 and 1895, alone number 1020 specimens. A more detailed account of this collection will be found in the separate report of the Botanist.

Mr Simon Davis of Brookline, Mass., has presented a collection of 60 species of fungi native of the eastern United States. A large number of interesting flowering plants and fungi have been received from Dr W. Haydon, of Marshfield, Ore.

Scientific investigations. The limited amount of time available for field work was spent chiefly in a reconnaissance of the vegetation and its ecological relations, about the eastern end of Oneida lake, a region of extensive sandy barrens, swamps and bogs, in addition to the interesting vegetation of the shores and shallow waters. This study will be brought to a close during the coming season. Observations were also made upon the vegetation of several of the sphagnum bogs of central New York and it is to be hoped that these observations may be brought together in a formal way at some future time. New localities for certain rare species are reported under "Notes on Local Floras."

Exchanges. It has been found desirable to distribute as exchanges many of the duplicate fungi and flowering plants of the herbarium, thus enriching our collections and making available much valuable space heretofore occupied by the stored material. Exchanges have been effected with Mr G. Newodowski of Kiev, Russia, from whom the herbarium has received a valuable collection of fungi, chiefly parasitic leaf forms, native of eastern Europe and the Russian Caucasus. From Brother Victorin, of Longueuil, Quebec, has been received in exchange a large collection of flowering plants representing the flora of our northern border.

Condition of the collections. Further progress has been made in the arrangement of the collections which, with minor exceptions, are now in permanent form. Although there is on hand considerable material, stored away in more or less inaccessible bundles, practically all the valuable material has now been labeled and placed in proper sequence in the herbarium and thus made available for study. This

has resulted in a great increase in the value of the herbarium for purposes of scientific research and is correspondingly appreciable to the numerous botanists who have had occasion to consult the collections during the past year.

Additions to the herbarium. The number of specimens of New York State species which have been added to the herbarium from current collections during the past year is 675, from contributions 336, from the Sheldon herbarium 1020, a total of 2031 specimens. Of this number, 75 species are new to the herbarium and 4 species are believed to be new to science. The extralimital specimens of the Sheldon herbarium number 13,382.

The number of those who have contributed specimens is 33. This includes those who have sent specimens merely for identification, which were desirable additions to the herbarium.

The current collections of the staff were made in the counties of Albany, Fulton, Madison, Oneida, Onondaga, Oswego, Rensselaer and Ulster. The specimens contributed are from the counties of Albany, Cayuga, Chemung, Dutchess, Erie, Franklin, Herkimer, Livingston, Madison, Monroe, Oneida, Onondaga, Oswego, Putnam, Rensselaer, Schoharie, St Lawrence, Tompkins, Washington and Wayne (including the New York plants of the Sheldon herbarium). The extralimital specimens contributed were from Arizona, California, District of Columbia, Illinois, Massachusetts, New Jersey, Oregon, South Carolina, Washington, Wyoming and Vermont; Ontario, Quebec and Russia.

Identifications. The number of identifications made of specimens sent or brought to the office by inquirers is 556. The number of persons for whom these identifications were made was 151.

VI

REPORT OF THE STATE ENTOMOLOGIST

The State Entomologist reports regarding insect depredations a continuance of the extended injuries by the apple tent caterpillar and the forest tent caterpillar. The work of the latter species was particularly evident on Long Island and in the Adirondacks. Popular warning notices were sent early to the press, and at Westbury and Elizabethtown, power spraying outfits were used most successfully against the forest tent caterpillar. The ten-lined inch worm was locally abundant in the Catskills and Washington county.

More detailed accounts of the subjects discussed in this chapter appear in the annual report of the State Entomologist.

Oil injuries. The serious results following the application of petroleum compounds to the bark of dormant trees have again come under observation. One of the most interesting of these cases was at Dalton, Mass., and resulted from the application in May 1913 of burlap strips soaked in lubricating oil to sugar maple trees planted some ten or eleven years previously. The Entomologist also examined a number of fruit trees in widely separated orchards where conditions favored the belief that the serious injury to the trees was due to an earlier application of a miscible oil.

Fruit tree pests. Studies of the parasitic enemies of the San José scale, begun in 1913, have been continued. This work has resulted in the finding of a number of orchards where these beneficial forms were abundant and apparently very effective agents in checking the pest. The most efficient species is the recently discovered and newly characterized Prospaltella perniciosi Tower, a form which is widely distributed in certain sections of the State, at least. In spite of the abundance of these natural enemies, it is believed that, as a rule, fruit growers must continue to rely upon the application of lime-sulphur washes for the control of this scale insect.

Field studies of *red bug* injury have shown that in the Hudson valley, at least, the lined red bug, Lygidea mendax Reut., is the species responsible for most of the damage to the fruit. Practical work in orchards indicates that a nicotine preparation such as "black leaf 40" is one of the most effective sprays. It is probable, in the case of badly infested trees, that a special application of nicotine and soap must be made somewhat later than it would be safe to use the lime-sulphur wash at winter strength.

The *pear thrips,* as shown by investigations of the last season, continues to be a serious pest of the grower in the Hudson valley, appearing here and there in a most erratic manner and injuring Seckel and Bartlett trees in particular. It was found that orchards practically free from the pest one season may be seriously affected the next. A detailed account of this insect has been given in the Entomologist's report for 1912. In at least one case pear midge injury, supplementing the damage caused by the thrips, resulted in an almost total loss of the crop.

The *pear psylla* has continued a serious enemy of the grower, being particularly abundant and injurious in certain extensive orchards in the vicinity of Milton and Marlboro. The practical value of late spring applications of a lime-sulphur wash for the control of this insect, was demonstrated earlier, and observations in these orchards showed the necessity of carefully eliminating artificial shelters, such as stone walls, brush heaps and even check trees, if the best results are to be secured.

The *banded grape bug,* Paracalacoris scrupeus Say, noticed in detail in the Entomologist's report for 1913, has continued its injurious work. Through the cooperation of Mr L. F. Strickland of the State Department of Agriculture a series of nymphs were received and detailed descriptions of the early stages have been drafted and are included in the report for the present year.

Gipsy moth. One of the worst infestations of the gipsy moth yet discovered in the State was located by the Entomologist last spring, with the cooperation of Mr F. A. Bartlett, at Mount Kisco. The infestation was of several years' standing and a few egg masses were found at a considerable distance from the center of the colony. Prompt and vigorous action by agents of the Department of Agriculture has resulted in nearly exterminating this menace, and it is most earnestly hoped that in another year or two this outlying colony will be entirely destroyed.

Brown-tail moth. A scattering infestation of the brown-tail moth was discovered early in the year on Fisher's island and the eastern end of Long Island. The pest very probably drifted with the winds from the adjacent infested mainland of Connecticut. Systematic scouting and the destruction of overwinter nests, by agents of the State Department of Agriculture and the Federal Government, have prevented extended multiplication the past season. The abundance of oaks on Long Island renders it very probable that this pest will breed freely in that section unless checked artificially. The prevalence of this insect in large numbers would

mean an inevitable drop in the prevailing high land values. The Entomologist, cooperating with other local and State agencies, is endeavoring to arouse a general interest in the control of this insect while the infestation is still in an incipient stage.

Grass and grain pests. There was an extended and serious outbreak of grasshoppers on the border of the Adirondacks, portions of Fulton, Saratoga and Warren counties, in particular, suffering greatly. Warning notices were issued, giving directions for checking the pests before the situation became serious, and later at the request of the Governor, a special study of the problem was made and, in cooperation with agents of the State Department of Agriculture, a most satisfactory demonstration of the efficiency of poisoned baits was conducted. The grasshoppers of the State have been carefully studied in this connection, and a detailed account of these insects, their capacity for harm and control measures is given in the Entomologist's report.

There were numerous local and, in some instances, severe injuries by *army worms* in mid July and early August. Newspaper bulletins giving full information respecting this insect and methods of control were issued at the inception of the attack. These outbreaks invariably arouse considerable apprehension because of the masses of caterpillars, though as a rule the damage is restricted to comparatively small areas. The work of the past season demonstrated the utility of poisoned baits similar to those employed against grasshoppers.

Studies of *white grubs* and *June beetles,* begun in 1912, were continued, one of the most interesting developments being the rearing of a number of a rather scarce robber fly, Promachus fitchii O. S., and the large, white maggots observed in association with and preying upon white grubs during both 1912 and 1913. Observations were also made upon the numbers of and injuries by the beetles, and later in the season upon the abundance of the small, white grubs, which latter, when numerous, invariably cause serious damage the following season. Local conditions were characterized in brief, practical accounts being sent to papers circulating in section where the pests were most abundant. Grass webworms, prevalent and injurious in a number of cornfields in Dutchess county, were investigated. Control measures, as has been demonstrated by earlier work, must be restricted largely to planting immune crops on badly infested land. These small insects are by preference grass feeders and, under normal conditions, may become exceedingly numerous on land allowed to lie in grass for a series

of years. An interesting and rare type of injury was observed in one of the infested fields. It was caused by a small, yellow field ant, probably Solenopsis debilis Mayr., eating out the contents of the kernel, and the corn sprout, thus deprived of its normal nourishment, developed very slowly.

Shade tree insects. Injuries by the elm leaf beetle continue as in previous years, though local restrictions were perhaps fully as marked as in earlier seasons. There was a great decrease in this pest in 1912, due, as the Entomologist then believed, to abnormally low temperatures in mid June, and the same phenomenon, though to a somewhat less extent, was observed last season. A study of the abundance of this insect in connection with the temperature records for the past decade has enabled the Entomologist to formulate a provisional rule as to the relation existing between the abundance of the beetle and low temperatures in mid June.

The *spruce bud scale,* Physokermes piceae Schr., a comparatively unknown pest in New York State, has been brought to our attention during the last two or three years from widely separated localities, and a study of the situation indicates a connection between infestation by this scale insect and the dying branches so frequently seen upon Norway spruce trees.

The Norway maple, hitherto regarded as comparatively free from insect pests, has been shown by the studies of the past season, to be subject to attack by a leaf hopper, Alebra albostriella Fall., and a scale insect, Leucaspis japonica Ckll. The former appears to be very serious at times, and the latter may prove to be a species of considerable economic importance.

Forest pests. The hickory bark beetle still continues as an important pest in the vicinity of New York City and here and there in the Hudson valley, though from the investigations the injury does not appear to be so extensive and severe as in earlier years. It is to be expected that natural enemies will soon begin to regain the ascendency, which already seems to be the case to a limited extent. It is undoubtedly true that conditions have been materially benefited by the somewhat general cutting and burning of badly infested trees.

The establishment of the recently introduced *bayonet* or *posthorn pine* borer, Evetria buoliana Schiff., in several New York localities, was investigated. This introduction adds another potentially important enemy to our list of pine pests. This European species has evidently been established in the country for several years, probably being brought here with nursery stock. The in-

festation is at present so limited that there is a possibility of exterminating the borer.

The *maple and oak pruner,* a rather common enemy of oaks, in particular, has been unusually abundant and injurious, especially in the lower Hudson valley and, as a consequence, many inquiries have been received concerning this insect and methods of control.

The large *European hornet,* Vespa crabro Linn., became established in this country several years ago, and during the last year or two has attracted notice by its habit of removing the bark from small, living twigs or branches, birches suffering in particular. Ordinarily this damage does not amount to much, though it might be considered serious in the case of specimen trees or shrubs on lawns.

Garden and greenhouse pests. The large, brilliantly colored Say's *blister beetle,* Pomphopoea sayi Lec., has again attracted notice because of its unusual abundance in various localities in the State. A brief warning notice was issued. One of the noteworthy features of the outbreak was the threatened destruction of the yield from an acre of beans.

Another unusual outbreak was that of the *Juniper plant bug,* Chlorochroa uhleri Stal., a stout, greenish, pink-margined stink bug which became excessively abundant and injurious at Quaker Street, Schenectady county. These bugs, ordinarily rare, were so numerous as to destroy many of the young peas while still in the pod and seriously affect the yield of several garden crops. A study of this insect was made in connection with the outbreak.

The orchid Isosoma, I. orchidearum Westw., is rarely brought to the attention of the economic entomologist, partly because of its scarcity and probably also on account of the fact that orchid growing is a highly specialized and therefore fairly well understood business. Pseudobulbs of orchids infested with this insect were received from Mount Kisco last July, and later in the season orchid roots infested with the Cattleya midge, Parallelodiplosis cattleyae Moll., were transmitted by another person. Both of these insects affect the vitality of the plants.

Flies and mosquitos. The interest in the control of the house fly has continued, and early in the season the Entomologist prepared a brief folder concerning the house fly. This was widely circulated in a monthly bulletin of the State Department of Health, and also issued separately.

Practical control of mosquitos has received its due share of attention, the Entomologist personally investigating a peculiar problem

on the shores of Sodus bay. The investigation started the past season will be continued another year in an attempt to abate the mosquito plague associated with swamps lying practically at lake level.

Gall midges. The European box leaf miner, Monarthropalpus buxi Lab., has become well established on Long Island and is seriously injuring box hedges, since many badly infested leaves drop and the plants soon become very scraggy. A series of experiments has shown the practicability of destroying these miners while still within the plant, by the use of fumigants, carbon bisulphide being the most promising.

Studies in this group (Itonididae) have been continued, and a number of new species, mostly reared, and several new genera described. There have been a number of important additions in this group to the New York fauna. The American zoophagous species, mostly beneficial because of their preying upon other forms, especially scale insects, plant lice and plant mites, have been tabulated. This compilation shows a possible importance as natural checks heretofore scarcely suspected.

Lectures. The Entomologist has delivered a number of lectures upon insects, mostly economic forms, before various agricultural and horticultural gatherings, some of them being in cooperation with the Bureau of Farmers Institutes or county farm bureau agents. Several lectures have also been given under the auspices of local improvement associations.

Publications. A number of brief, popular accounts regarding such common pests as the house fly, apple and forest tent caterpillars, the elm leaf beetle and June beetles, have been widely circulated through the press. The more important publications of the year are " The Gall Midge Fauna of New England," and several papers describing new genera and species of gall midges.

Faunal studies. The investigations of earlier years along these lines have been continued, and there is now in manuscript a list of the insects of the Adirondack region, based mostly upon material in the State collections. There was some special collecting in the Adirondacks in connection with the investigation of grasshoppers noted above, and Assistant State Entomologist Young continued his studies of the fauna at Wells, paying special attention to the hitherto largely neglected Mycetophilidae, and obtaining a number of new species and also of known forms not previously recorded from the State.

Collections. A large series of insects was obtained by purchase from the Kny-Scheerer Company of New York. These are for the exhibit collection now being prepared and were selected primarily because of their value in supplementing or elucidating the material already at hand. The similarities obtaining among insects in different sections of the world, the remarkable developments in certain highly specialized forms, and the enormous size of some species are well illustrated in these recent acquisitions.

Through exchange with Mr C. W. Johnson of the Boston Museum of Natural History, the Museum has acquired a series of 83 species (listed elsewhere) of two-winged flies, mostly unrepresented in the collections. These being determined by a well-known authority in the group, constitute a notable addition to the State collections.

The entomological division has received, through exchange, from Prof. S. I. Kuwana of the Board of Plant Inspection, Imperial Ministry of Agriculture and Commerce, Tokio, Japan, specimens of 30 species of Coccidae, a number of them representing species described by Professor Kuwana and therefore particularly desirable.

Accessions such as those mentioned above add greatly to the value of the State collections, especially when the group is economically important, as is the case with the Coccidae or scale insects. There have been numerous additions during recent years in this family. There are now in the collections 181 species, 72 of which have been mounted on microscopic slides, 4 being represented only by such preparations. There are 41 species from Japan, 28 from California, 7 from the Philippine Islands, and 9 types and 7 cotypes. This assemblage is a most valuable aid in determining the scale insects so frequently submitted for name. The Coccidae are so readily transported with nursery stock that species of extralimital forms are very desirable. Only last summer there was found on Norway maple, a Japanese species which may prove of considerable economic importance.

Additions are constantly being made to the State collections, especially of specimens representing the early stages and work of various injurious forms, since biological material of this character greatly facilitates identification of the different insects and is indispensable in a well-prepared exhibit illustrating the life histories of different species. The State collection now contains a large amount of material which is invaluable because of the associated data. Many microscopic preparations of smaller insects have been made and incorporated in the collections as in earlier years.

The arrangement and classification of the collections require a large amount of time. The many additions must be interpolated and there are numerous groups still far from being thoroughly classified. The large series of Lachnosterna captured during the past summer were determined by Mr Young. The collection of grasshoppers taken in connection with the grasshopper investigations referred to above, necessitated the rearrangement of the Orthoptera.

Nursery inspection. The nursery inspection work of the State Department of Agriculture results in numerous specimens representing any stage in insect development, some in very poor condition, being submitted for identification. As such material may originate in a foreign country, determinations of this character are laborious and require for their successful prosecution a large collection and an excellent library of both domestic and foreign works. The correct identification of such material is very important, since the disposal of entire shipments of nursery stock must depend in considerable measure upon the character of the infestation.

General. The work of the office has been materially aided, as in past years, by the identification of a number of species through the courtesy of Dr L. O. Howard, chief of the Bureau of Entomology, United States Department of Agriculture, and his associates. A number of correspondents have donated valuable specimens, listed elsewhere, and many have rendered efficient service by transmitting local data respecting various insects. There has been as in the past, a most helpful cooperation on the part of all interested in the work of the office.

VII

REPORT ON THE DIVISION OF ZOOLOGY

In the zoological section of the Museum substantial progress has been made, although from the nature of the work to be done, this section has been more affected than some of the others by the small amount of technical and expert assistance that it has been possible to provide. Temporary arrangements and expedients have been avoided as much as practicable, and the work that has been done has been carried out with a regard for the permanence and future growth of the exhibit, so that it will not have to be done over again.

Owing to the slow progress in installing the exhibition cases in the zoology hall and preparing the room for occupancy, the work of arranging the specimens in the cases could not begin much before the end of December, but has been continued steadily since that time, and by the end of the fiscal year many of the cases were completely or nearly completely filled and arranged, and most of the others had received a considerable part of the material which it is planned to exhibit in them. Those reserved for invertebrates, and a few of the large group cases, still remained empty, but the work was far enough advanced to make the collection well worth a visit from those with even a small interest in zoology or nature study, and to require only the finishing of several of the large mammal groups to remove most of the appearance of emptiness and incompleteness which the room still presented.

The large and handsome series of *domestic fowls,* donated by the New York State Agricultural Society but never properly displayed in the old building, has been installed, and forms one of the most instructive and attractive features of the Museum. It occupies a series of alcove cases extending along nearly the entire east side of the room. In a corresponding position on the west side the *wild birds* of the State have been installed, but in this collection a number of species are still wanting or represented only by inferior specimens. These deficiencies are being filled as fast as the required specimens can be obtained. The systematic collection of the *eggs* of the New York State birds has been displayed in a series of inclined-topped cases adjacent to those containing the birds. The sets of eggs are shown in black cardboard trays containing blackened sand or sawdust, which sets off the colors and markings of the specimens in a very attractive manner. This collection is, however,

by no means as complete as it should be, as even many of the commoner kinds are insufficiently represented or wanting entirely, and additions to the series are very much desired.

The Museum's collection of *birds' nests* is only a very small one, but most of them have been put on exhibition, the smaller ones in the cases with the birds to which they belong. The nests of most of the larger birds are too bulky to be provided for in this way, but in many cases special groups consisting of the nest, parent birds and young or eggs have been planned, and much material for such groups already acquired. Other series of specimens which have been partly installed are the *mammals,* in which the Museum is still unfortunately quite deficient; the *reptiles* and *amphibians,* which are shown mainly by casts and mounted specimens, avoiding the unsightly and discolored alcoholic material commonly used; and the skeletons. The *fishes* of New York have been put in order and are now nearly all mounted in the cases along the corridors of the rotunda. Work on the large groups in the central part of the room has progressed favorably. The *puma* group is completed and the *moose* and *buffalo* groups far advanced toward completion. A large group of *whistling swans* promised by a friend of the Museum, is said to be approaching completion, though it had not yet been delivered when the year came to a close.

Accessions to the collections of considerable importance have been made during the year. The most important addition is a large series of native birds and mounted fishes deposited by the Conservation Commission. The fishes were an especially welcome accession, comprising over one hundred examples of the principal native game and market fishes, most of them unusually large and fine specimens, and well mounted. This collection was brought together by Dr Tarleton H. Bean, the State Fish Culturist. Other important accessions are a series of mounted birds of species native of New York purchased from Mr Fred Barker of Parker's Prairie, Minn., and some exceptionally fine wax casts of amphibians, chiefly frogs and salamanders, made by Mr Dwight Franklin, who has done much work of a similar character for the American Museum of Natural History. The skeleton of a right whale has been acquired and will presently be mounted, and a collection of the principal breeds of domestic pigeons to supplement the series of domestic fowls which the Museum already possesses.

VIII

REPORT ON THE DIVISION OF ARCHEOLOGY AND ETHNOLOGY

During the fiscal year much of the work of the archeology division has been the sorting, cataloging and classifying the thousands of specimens. Within the year more than 15,000 specimens have been added to the collections making, with those reported last year, a total of over 30,000. There are many duplicates of the more ordinary objects, such as stone knives and net sinkers, but from the various collections it has been possible to select a remarkable series of objects illustrating the facts of New York archeology.

There has been some necessary delay in the matter of getting the cases properly placed, due to the separation of the archeological and ethnological exhibits.

The largest collections obtained during the year are those of Prof. D. F. Thompson, Otis M. Bigelow and L. D. Shoemaker. These collections are from three archeologically important regions in New York, the upper Hudson, central New York (Onondaga-Seneca river) and the headwaters of the Susquehanna.

THE NEW COLLECTIONS

The Museum has continued its plan of acquiring large collections representing special areas within the State. During the past two years forty or fifty collections have been examined and studied. Of this number, ten collections were selected last year. Within the year just closing ten more have been obtained. Not all this material is for exhibition purposes, the greatest quantity being reserved for study and comparison. Every scientific museum must have an abundance of material in its unexhibited "duplicate" collections. There are, on the other hand, thousands of specimens that are specially suited for exhibition in the cases of the Museum and these have been carefully selected for this purpose.

Among the principal collections or lots, acquired during the year are the following:

By purchase

From L. D. Shoemaker, Elmira	1 250
Dwinel F. Thompson, Troy	3 500
Otis M. Bigelow, Baldwinsville	10 000
E. R. Burmaster, Irving	126
Smaller collections	50

By collection

From D. D. Luther, Naples	47
A. C. Parker, Albany	36

By donation

From W. D. Gebhard, Schoharie	27
Walter Hutchins, Albany	415
E. Reinhard, Buffalo	88
	15 539

It will be observed that these collections have come from several important localities not heretofore well represented in the State Museum archeological collections.

The collection made by Mr L. D. Shoemaker of Elmira is an admirable example of a well-arranged collection of surface finds. Each specimen is numbered and cataloged and a map and description of the localities accompany it. Its value lies in the fact that it delineates the archeology of the valleys of the Susquehanna, Chemung and Tioga. These localities were the routes of many wandering bands of aborigines from early times, and continued so as long as there were Indians situated on or near those several waterways.

By far the most important collection obtained is that brought together by Mr Otis M. Bigelow of Baldwinsville. It was not originally amassed with any special scientific intent but, seemingly, merely as a collection of Indian "relics." No special pains were taken to make a scientific catalog or to chart the sites from which the various objects came, but Mr Bigelow, before turning the collection into the Museum, made an effort to classify the localities and give a correct record of each object. All the principal specimens have full data accompanying them and thus much may be learned of archeologic importance.

The collection obtained from Prof. Dwinel F. Thompson of Troy consists mostly of objects acquired in the territory in and adjacent to the upper Hudson valley. There are also many good specimens from the Mohawk and from the Genesee valleys. Professor Thompson made his collection in a systematic manner and kept a careful record of all his specimens. Every article has an index number and a locality mark, both neatly applied.

The Bigelow collection. This represents the efforts of the collector during the past fifty-five years to gather representative

Monitor pipes and copper objects from New York

Tubes and pipes from Mound Builder sites in New York

material from the region about the Seneca river, Onondaga lake, Oneida lake and the hilly ground south of Syracuse. A field examination of this area shows it to have supported large populations of the aborigines for lengthy periods and evidently from remote times. Several considerations undoubtedly attracted these early inhabitants, among them the accessibility of the various portions of the surrounding country by means of lakes and streams, the abundance of fish and game, and the rich soil for agricultural purposes. Thus the larger number of specimens in the Bigelow collection consists of hunting, agricultural and domestic objects.

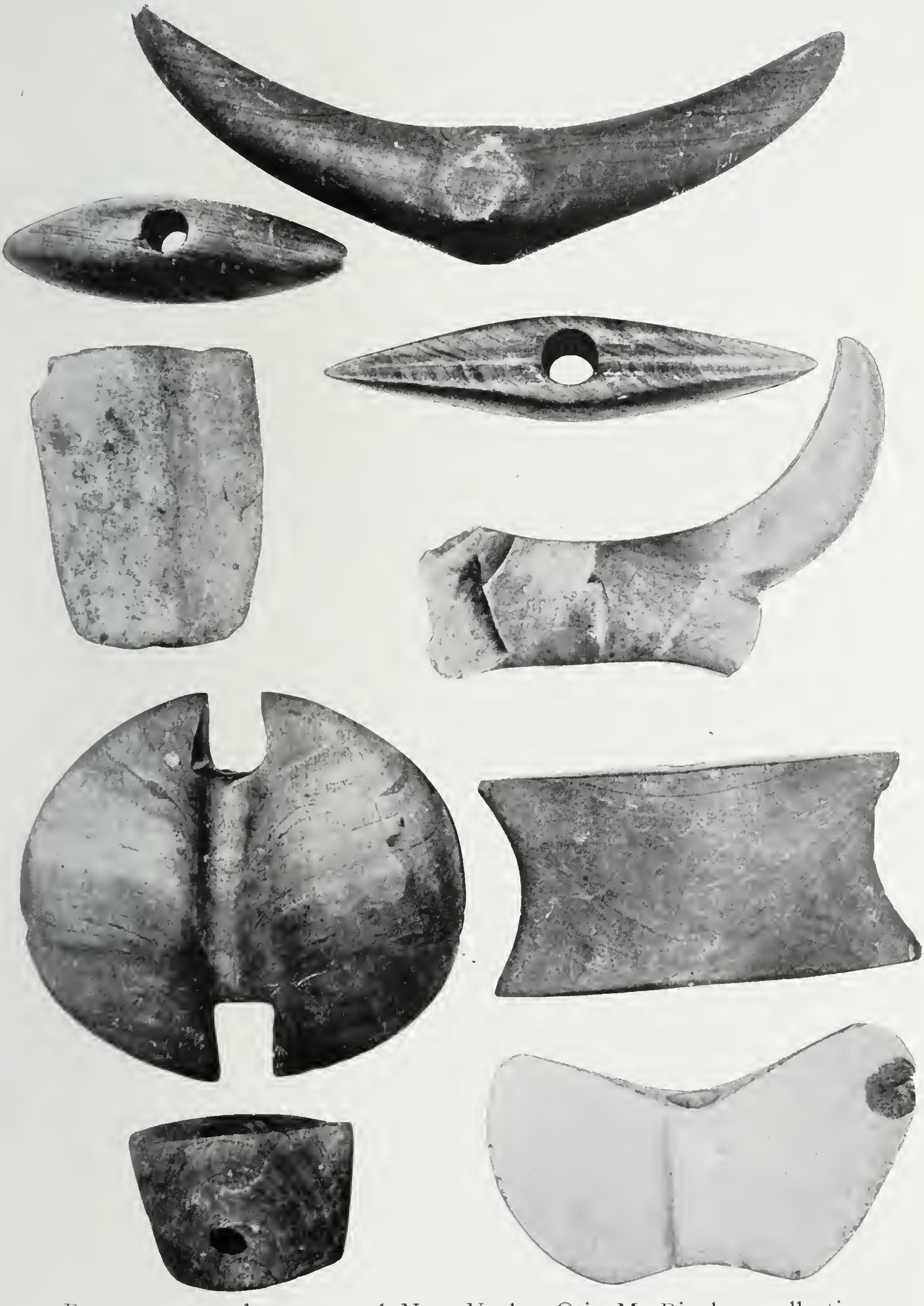
Four distinct cultures are represented in this collection, that termed the Eskimoan, characterized by slate knives and semicircular chopping knives, etc; the early Algonkian; the Mound Builder, and the Iroquoian. For the sake of convenience, it is better to term these occupations as pre-Iroquoian and Iroquoian. Most of the material consists of stone objects, in which class the chipped chert implements lead in numbers. Then follow the polished stone implements, principally chisels, gouges and stone axes or celts. There is also a small series of stone pipes. Among the objects having no known utilitarian purpose are gorgets, banner stones, boat stones, bird stones and the bar-amulets.

In the series of more than five thousand chipped implements there are many varied forms ranging from immense knives 10½ inches long and 5 inches broad to tiny arrowheads but little larger than those known as bird points of the Oregon type. There is a wide variety of scrapers, knives, spearheads, drills and other implements of peculiar shape. The range of material shows that the region, especially that of the Seneca river district, acquired much material from foreign sources. The local material is the chert found in the Onondaga limestone but the quantity and variety of extralimital material indicates a traffic with other regions. There is a certain amount of quartz presumably from quartzite boulders, though some of the quartz material may have been made from small pebbles. A good share of these implements were made from yellow jasper similar to that found in Berks county, Pa. There is a considerable amount of flinty material similar to that from the Flint ridge, Ohio. It is very evident from an examination of the chipped implements that the common chert or flint was obtained from many sources. The rare materials are moss agate, obsidian, chalcedony and argillite.

The cutting implements are hatchets, adzes and gouges of several forms. Some of the gouges are flattened on each side

and carry only a short depression terminating not more than one-half the length of the implement, making a short-mouthed gouge. One form of this implement is flattened on the lower surface but rounded on the back. A more finely finished type of gouge has the groove continuing from the cutting edge through to the butt end. With few exceptions, this form of adze is finely finished and polished. The celts consist of three general forms which, however, have subvarieties. The flattened celt seems to have been used mostly as an adze. This form embraces specimens with side equally flattened, specimens with one side flattened and the other slightly rounded, and specimens with one side flattened and the upper portion greatly rounded. A variety of the last named form has the upper side beveled in five planes. A series of small chisels varying from 1½ inches to 3 inches in length coincide with all these described forms. The more general form of the celt consists of specimens averaging about 6 inches in length and having elliptical cross-sections at the center. The cutting edge, as in nearly all forms of these implements, is convex. The material varies from that of diabase, granite, compact sandstone, schist and the more compact forms of metamorphic rock. The third general form is that of the celt having wide cutting edge and tapering down to the butt so that its general form resembles that of the Arawak type. These celts merge, when arranged in series, to the long bar-celt, some specimens of which are 10 or 12 inches long and 1 inch wide and thick. Nearly all the forms of these celts have their counterparts in smaller implements which were presumably used as chisels. The grooved axes from that vicinity are quite rare, not more than a dozen specimens being represented in the collection.

The Bigelow collection of polished slate implements is especially rich in tubes, banner stones, bird stones, and gorgets. There are several varieties of tubes, consisting of specimens partially drilled and others beautifully formed and finely finished, some being cigar-shaped and tapering to a slender stem toward the mouth. Some seem to have been used as pipes while others do not have a form that would indicate this function to have been feasible. The series can be arranged to show the evolution of the stone pipe from the tube form by the gradual uptilting of the bowl end. One specimen, tubular in form, is incompletely drilled and has a pipe stem hole bored in one side. Some of the tubes are short and flattened and are not greatly dissimilar from the narrow winged and thick banner stones.



Banner stones from central New York. Otis M. Bigelow collection

Bird stones and bar amulets from Central New York.
Otis M. Bigelow collection

Effigies from pipe bowls from Onondaga county site. Otis M. Bigelow collection

The collection contains several forms of the banner stone, the more common type being oval in outline with either end truncated. The so-called butterfly shape does not appear and none of the specimens have the indented top and base. Another form is reel-shaped with concave sides. Still another, represented by five specimens resembles up-turned horns. This type is thicker in proportion to the others and the hole somewhat larger. There is a pick-shaped implement with a lateral groove on the flattened under side. This form grades into an oval-shaped pick somewhat resembling a war club head or an elongated sharp-pointed oval. A further evolution shows the type flattened, and then come two specimens of this form which are not drilled. They might have been prepared either for banner stones or for boat stones. The boat stone, however, has two small holes drilled from the under side. It is interesting to note in this connection that all these implements in their various forms may be arranged to show how one shape may merge into another. Thus, it has not been difficult to show how a problematical object shaped in general like a boat may gradually merge into the classification of the gorget or the bird stone. The Bigelow collection is rich in many specimens of both these types and contains many peculiar forms of both the gorget and the bird stone.

There was a time, according to the statements of the older collectors, when the copper implements from the Seneca river and from the western end of Oneida lake were so common that no particular attention was paid to them. If the local collector desired any specimen for his collection it was a finely formed arrowhead, spear, or stone axe. Farmers in that region would save up the copper implements until they had several pounds when they would bring them to the villages and sell them to the tinsmiths. Mr Bigelow, however, was fortunate in preserving about twenty specimens of copper implements. These consist of arrowheads, spears, adzes, chisels and one mattock or pick. Some of the smaller implements have long pronged shafts, similar to that of modern knives, which provide for insertion into a wooden handle. Other types have a flange. The flange in the mattock, which weighs several pounds, is particularly conspicuous. The Museum is fortunate in having this rich collection of New York native copper implements. All the implements resemble in every detail those found in Wisconsin, Michigan and Minnesota and seem to have been made by similar people. Native copper implements are not found inclusively in Iroquois sites in New York.

Another early type of implements are the polished slate knives similar in every way to the Eskimo forms. The ulu or semilunar knife is also of the common Eskimo form. There are several perfect specimens of these objects. Two bayonets made of slate are included in this collection.

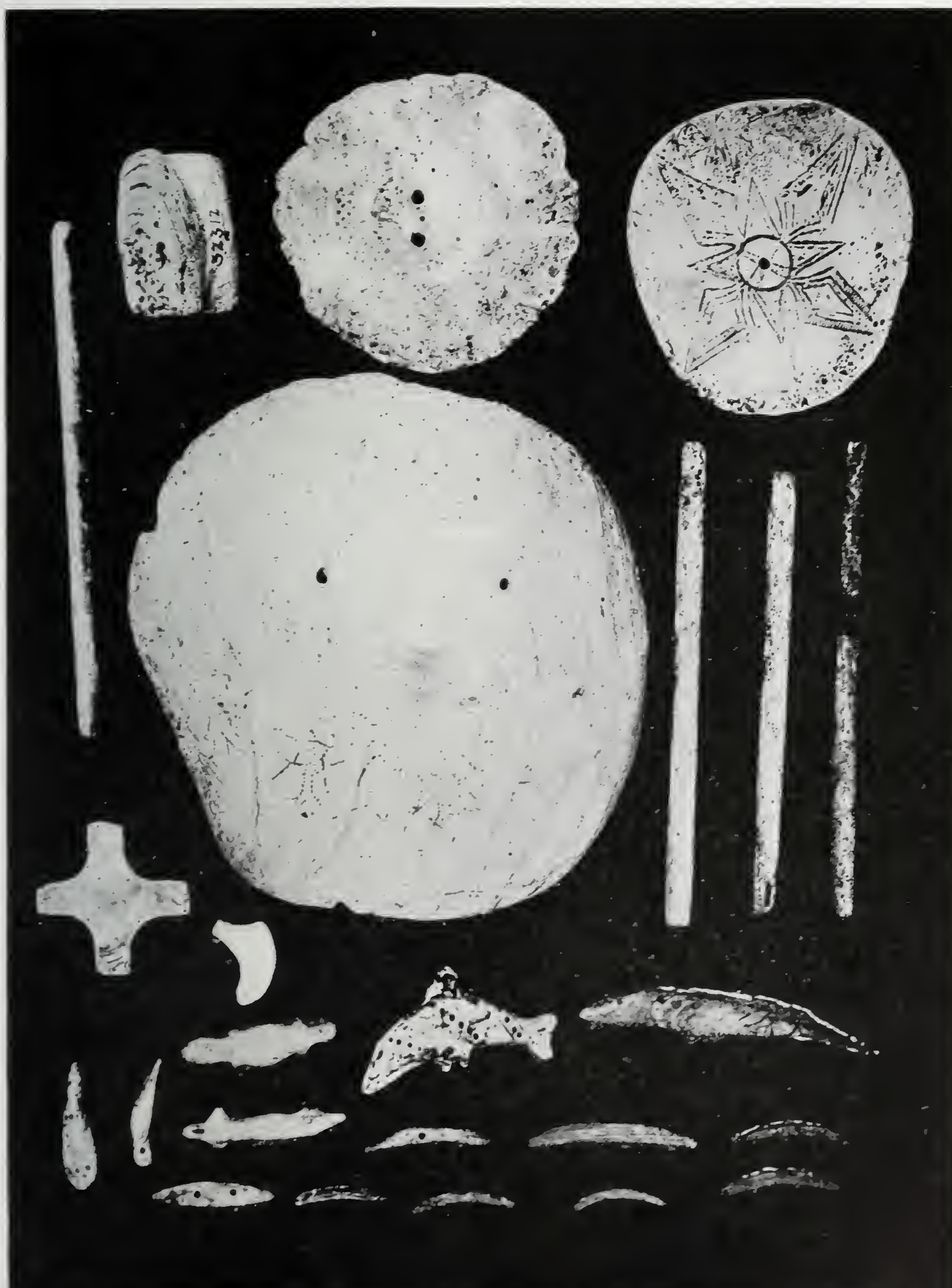
There are very few stone pipes in the Bigelow collection, especially those from the pre-Iroquoian occupations. Four or five pipes of the modified monitor type embrace all the specimens obtained by Mr Bigelow. A most interesting form is that of a turtle having the pipe bowl in the center of its back. No stem seems to have been used. Iroquois pipes, however, are fairly numerous and were found on later sites of this occupancy. The clay pipes, especially those from the hills about Pompey, show considerable skill in modeling. The principal decorations are zoomorphic. There are representations of the human face, the human body and hands, and effigies of animals and of birds. On several specimens the effigy of a serpent is used as a decoration.

Implements of bone in this collection have come mostly from the Iroquoian sites among the Onondaga hills. They embrace representative series of awls, punches, harpoons, tubes etc. Equally interesting are the objects of antler which embrace arrow points, pitching tools, punches, knife handles, spades and combs. Among the more interesting specimens are the drilled and cut teeth of animals. There are many other forms of implements which we are not able to mention specifically. The Bigelow bone collection has been studied and examined with considerable care and some specimens deserve the closest scrutiny.

Objects of shell are not numerous. Few of the specimens come from the older sites; in fact nearly all specimens have come from sites in which European objects were found.

As may be judged, large quantities of broken pottery were discovered in all the various sites from which Iroquoian implements came. The Iroquoian pottery is similar to that of all other regions where it is discovered; for example, Jefferson county, the Genesee river and western New York.

One of the finest complete specimens of the Iroquoian pot ever found is included in the Bigelow collection. It was found by Mr Percy Purdy in a cliff cave on the banks of the Indian river, in the town of Theresa, Jefferson county. It is of typical Iroquoian pattern having a constricted neck and raised collar above which project four points, each 6½ inches apart. At each point is the conventional Iroquoian representation of the human face, made



Shell ornaments from central New York. Otis M. Bigelow collection

Semilunar choppers, slate knives and bayonet stones. From Central New York.
Otis M. Bigelow collection

Clay vessel from Theresa, Jefferson county. Found in a rock crevice by Percy Purdy

Algonquin clay vessel from Chenango Valley. Otis M. Bigelow collection

by three dots or small circles. The border decoration is narrow but consists of the usual pattern of parallel oblique lines arranged in triangular plats. The edge of the rim is notched or indented at intervals of about three-eighths of an inch on both inner and outer edges. The pot is 14½ inches high and is 39 inches in circumference at the middle of the globular body.

The inside of the vessel is smooth but the interior of the neck seems to have been given an overwash of clay before baking. It has the appearance of having been smoothed down while the clay was still quite moist. The outer side of the neck is smooth but the body of the vessel has been patted with a potter's paddle having oblong patterns, so that the surface of the clay shows outlines of indented oblongs slightly impressed. The vessel has a fracture, caused no doubt by frost.

The Dwinel F. Thompson collection. The collection brought together by Professor Thompson contains specimens acquired mostly from the upper waters of the Hudson river beginning with certain sites in the vicinity of Troy. The principal sites in the Troy region from which he obtained specimens are Lansingburg, Waterford and Green Island. Northward of this region specimens were acquired in sites from the Hoosick valley, Saratoga county and the Champlain valley, as far north as Plattsburg. The collection embraces a number of important articles from the vicinity of Catskill, N. Y. By exchange, Professor Thompson obtained specimens from Monroe county and by excavation certain material from one or two sites in the Mohawk valley.

Perhaps the most interesting object in the collection is that of a large entire pottery vessel of the Iroquois type. It has a diameter through the body of 9 inches and a height of 10½ inches. An interesting feature of the rim is that it has three projecting points instead of the usual four. These points are regularly placed, being 6⅜ inches apart. The collar is decorated in the usual Iroquoian way with straight lines. The upper portion on the angular edge is notched as is also the inner side of the rim which curves inward sharply. Below the notched edge there are four parallel lines encircling the collar, below which are series of parallel straight lines slanting to the right. The collar terminates into a scalloped bottom overhanging the body of the vessel. The collar is curved inward to the constricted neck which is rather short, being not more than 1½ inches in length. The pot is nearly perfect and there are only slight cracks in it. These run from one side below the center of the body in a V-shaped fracture to the bottom of the pot where

there is a Y-shaped crack. One of the points is also fractured so that it presents a wedge-shaped break. The vessel was found in a rock shelter and still has upon one side to the left and below the broken point an eroded surface yet covered with dry moss. In size, form and decoration it is similar to the many fragments of pottery from the Mohawk valley, in the collection. Nearly all the vessels seem to have been as large or considerably larger than the Thompson specimen.

The specimens in Professor Thompson's collection marked from the Champlain valley indicate there was a continued occupation of the people who made polished stone implements such as bird stones, banner stones, boat stones and gorgets. Ungrooved axes or celts are numerous in this collection and there is a good representation of gouges. Grooved axes are represented by a number of good specimens.

A very interesting locality represented by relics is that in the vicinity of Schaghticoke in the Hoosick valley. The chipped flint implements from this region are numerous and varied in material and form. There are numerous large cache blades, large spearheads, arrow points and an abundance of unworked and rejected flint material. There are also flint hammers and abrading stones. The ordinary celt does not seem to be abundant in this region, there being an almost equal number of grooved axes. There is no clay pottery among the acquisitions of this collection but a considerable number of broken soapstone potsherds. The largest and most finely worked pestle is from this vicinity. It is long and slender and as perfectly formed as can be expected from early artisans. In length it is $21\frac{5}{8}$ inches and the diameter of the lower or pounding end is $1\frac{9}{16}$ inches. This tapers to a diameter at the top of three-fourths of an inch. The material seems to be a compact schist of dark color. There are smaller pestles well worked, some being less than 8 inches in length. Stone choppers or crude axes chipped from quartz and limestone were common on the Hoosick valley sites. Among the polished stone implements may be mentioned fragments of finely wrought banner stones including one specimen partially drilled but unfinished.

There are three fragments of the semilunar knife and one entire but unfinished specimen. The largest specimen in the State Museum collection from this vicinity was that presented by Albert C. Hurd and reported two years ago.

Important specimens from the vicinity of Catskill are sinew stones, several finely wrought pestles, several disklike stones and one fine specimen of a semilunar knife.

Mohawk pottery vessel from Mohawk Valley. D. F. Thompson collection

The vicinity of Catskill was an important one to the aborigines who reached it from the Mohawk valley by the way of the Schoharie creek. It was at one time the southern border of the Iroquois possessions but all the specimens from this region represented in the Thompson collection are pre-Iroquoian and presumably Algonkian.

In the Director's Report of 1905 is described a copper necklace taken from a grave in the vicinity of Athens. This necklace may or may not be modern Algonkian. The beads and the workmanship of the shell ornaments with them are similar to those from the so-called mound culture. Some of the Thompson articles are from this region.

Professor Thompson was careful to collect many hundreds of fragments of flint and broken specimens of flint points. From such materials we are able to determine the types of points used for material selected and the various stages of manufacture. The collection contains nearly all the tools of stone used for chipping flint.

The L. D. Shoemaker collection. The collection acquired from Mr L. D. Shoemaker of Elmira contains representative specimens collected on more than thirty sites in the Chemung valley and regions about Elmira. The more important specimens are polished stone implements, large fragments of Algonkian pottery, cylindrical pestles, flat and saucer-shaped mortars and nearly one-half of a large soapstone pot.

Specimens in the Shoemaker collection from the various sites indicate that the occupation of this region was mostly Algonkian. There are numerous crude axes, stone hammers and stone balls with a fine representative series of flint implements and net sinkers and other crude utilitarian objects.

Curatorial work. It has been no easy task to examine the thousands of specimens that have been acquired during the past two years. The work of making complete and thorough examinations of the several collections has, however, been an imperative requirement due to the necessity of selecting not only the proper material for exhibition but to set aside valuable material for study. It is gratifying to report that, though many other demands were made upon this section of the Museum, more than thirty thousand such examinations were made, and by the close of the year the Archeologist had selected and set aside such objects as are to be shown in the exhibition compartments. The archeologic cases of the C and D types, as soon as installed in the present hall of archeology, were filled with specimens. The B cases containing wooden steps, which had originally been ordered for the botanical exhibits,

were found inadequate for our purposes and had to be changed. The material eventually to be installed in them, however, was entirely selected before the close of the year and will be ready for installation shortly after January 1, 1915.

In the examination of collections containing so great a quantity of material there is afforded a splendid opportunity for obtaining important information regarding the occurrence of the various types and their distribution.

The work of cataloging the many objects has been intrusted to Mr Howard A. Lansing. This tedious and painstaking work he has carried on with great patience. All the new acquisitions are now numbered and recorded on cards and each specimen bears a number referring to its index card. This card gives the name of the object, the locality in which it was found, the finder, the collection in which it was found and a brief description. Further reference is made to the original catalogue or notebook of the collector. To complete our catalogue satisfactorily will require much additional time, as these cards will contain accurate descriptions of all the objects, and drawings or photographs of the more valuable ones.

None of the specimens have the index or reference number applied by means of a paper label, which has proved unsatisfactory for archeologic cataloging. All numbers are applied by pen or brush directly upon the specimen with waterproof ink. The number is placed in as inconspicuous a place as possible so as not to detract from the exhibition value of the object or unduly mar its appearance.

Archeological exhibit cases. During the middle of the year it was found that the archeology division was gaining such importance that a hall separate from the ethnological exhibits was required. The hall assigned to botany seemed not likely to be used for some time to come. Room 415, the eastern mezzanine, was therefore set aside as the archeology hall. The cases designed for archeology and previously installed in the hall of ethnology, room 420 (the west mezzanine hall), were removed and installed in room 415. The cases designed for the botanist were rearranged and the hall fitted for the archeological exhibits.

Public interest. During the year just past there has been a healthy increase in the interest in the archeological division of the Museum. This is not only attested by the many inquiries and requests, but also by the personal visits of archeologists and ethnologists from this country, Canada, South America and Europe. There

is a constantly growing demand for the publication of our manuscripts and for information concerning the facts of New York archeology and ethnology.

Facts are constantly required by artists, students, historians, producers of plays, pageants and historical exercises. There is also an increasing demand for suitable Indian names for geographical localities, for estates, camps, boats, clubs, and commercial concerns. The Archeologist suggested most of the names, for example, for the various mineral springs at Saratoga. Suggestions and plans for out-of-door pageants were given to several organizations, including the Lake Placid Club, the Agricultural College at Cornell, and the American Scenic and Historic Preservation Society; the Boy Scouts, Camp Fire Girls and similar clubs have been furnished with names, symbols and practical suggestions bearing on Indian life. Our activity during the year has covered a wide range of subjects of the present-day interest.

We are assured that our Iroquois Indians themselves look to the Museum and its Indian division as the chief means for the preservation of their history and records. In connection with the Indian of today we have therefore sought to represent them and their interests in various organizations and conferences, a duty that the Universal Law would seem amply to justify.

IX

PUBLICATIONS

A list of the scientific publications issued during the year 1913–14, with those now in press and treatises ready for printing, is attached hereto. The publications issued cover the whole range of our scientific activities. They embrace 1498 pages of text and 190 plates.

ANNUAL REPORT

1 Tenth Report of the Director, State Geologist and Paleontologist for the fiscal year ending September 30, 1913. 158p. 29pl.

Contents

MEMOIRS

Zoology

2 No. 12 Birds of New York, volume 2. General Chapters; Land Birds. 719p. 64pl.

Contents

BULLETINS

Geology and Paleontology

3 No. 168 The Geological History of New York State. By William J. Miller. 1913. 130p. 43pl. 10 maps.

Contents

Chapter 3: Precambric History
Chapter 4: Paleozoic history
Chapter 5: Mesozoic history
Chapter 6: Cenozoic history
Appendix
Bibliography
Index

4 No. 169 Geology of Saratoga Springs and Vicinity. By H. P. Cushing and R. Ruedemann. 1914. 178p. 20pl. Map.

Contents

Introduction
Location and character
General topography
General geology
Descriptive geology
Historical geology
Economic geology
Control of development and history of Saratoga region by the geology
Index

5 No. 170 Geology of the North Creek Quadrangle, Warren County, New York. By William J. Miller. 1914. 90p. 14pl.

Contents

Introduction
General topography and geology
Rocks of the region
Structural features
Topography
Glacial and postglacial geology
Summary of geological history
Economic geology
Index

6 No. 171 The Geology of the Syracuse Quadrangle. By Thomas Cramer Hopkins. 1914. 80p. 20pl.

Contents

Introduction
Geologic column of the Syracuse area
Stratigraphy
Economic geology
Structural geology
Physiographic features
Periodotite dikes
Notes on the Fossils of the Paleozoic Formations within the Syracuse Quadrangle. Burnett Smith
A Review of the Mammalian Remains from the Superficial Deposits in the Vicinity of Onondaga Lake, New York. Burnett Smith
Explanations of plates
Index

7 No. 172 Geology of the Attica-Depew Quadrangles. By D. D. Luther. 1914. 32p. Map.

Contents

Introduction
Description of formations
Siluric
Devonic
Bibliography
Index

8 No. 174 The Mining and Quarry Industry of New York State. By D. H. Newland. 1914. 111p.

Contents

Introduction
Mineral production of New York
Cement
Clay
Production of clay materials
Common building brick
Front brick

X

STAFF OF THE DEPARTMENT OF SCIENCE

The members of the staff, permanent and temporary, of the Department of Science as at present constituted are:

ADMINISTRATION

John M. Clarke, Director
Jacob Van Deloo, Director's Clerk
Paul E. Reynolds, Stenographer

GEOLOGY AND PALEONTOLOGY

John M. Clarke, State Geologist and Paleontologist
David H. Newland, Assistant State Geologist, *Curator of Geology*
Rudolf Ruedemann, Assistant State Paleontologist, *Curator of Paleontology*
C. A. Hartnagel, Assistant in Geology, *Curator of Stratigraphy*
Robert W. Jones, Assistant in Economic Geology, *Assistant Curator of Industrial Geology*
D. Dana Luther, Field Geologist
Herbert P. Whitlock, Mineralogist, *Curator of Mineralogy*
George S. Barkentin, Draftsman
H. C. Wardell, Preparator, *Assistant Curator of Paleontology*
Theodore J. Lipsky, Stenographer
Charles P. Heidenrich, Mechanical Assistant
Joseph Bylancik, Junior Clerk

Temporary experts

Areal geology

Prof. H. P. Cushing, Adelbert College
Prof. C. H. Smyth, jr, Princeton University
Prof. James F. Kemp, Columbia University
Prof. W. J. Miller, Hamilton College
Dr C. P. Berkey, Columbia University
G. H. Hudson, Plattsburg State Normal School
Dr W. O. Crosby, Massachusetts Institute of Technology
Prof. George H. Chadwick, St Lawrence University
James C. Martin, Princeton University

Geographic geology

Prof. Herman L. Fairchild, University of Rochester
Prof. James H. Stoller, Union College

Paleontology

Edwin Kirk, Washington, D. C.
Winifred Goldring, Slingerland
Edwin J. Stein, Albany

BOTANY

Charles H. Peck, State Botanist
Homer D. House, Assistant, *Curator of Botany*

ENTOMOLOGY

Ephraim P. Felt, State Entomologist
D. B. Young, Assistant State Entomologist, *Curator of Entomology*
Fanny T. Hartman, Assistant, *Assistant Curator of Entomology*
Anna M. Tolhurst, Stenographer
A. S. McGaughan, Page

ZOOLOGY

Willard G. Van Name, Zoologist, *Curator of Zoology*
Arthur Paladin, Taxidermist

Temporary experts

Prof. E. Howard Eaton, Canandaigua
Dr H. A. Pilsbry, Philadelphia
Charles E. Mirguet, Rochester

ARCHEOLOGY

Arthur C. Parker, Archeologist, *Curator of Archeology and Ethnology*
Noah T. Clarke, Technical Assistant, *Assistant Curator of Archeology and Ethnology*

Temporary assistant

Howard A. Lansing, Albany

XI

ACCESSIONS TO THE COLLECTIONS

MINERALOGY

Donation

L. G. Sheldon, Richville
- Serpentine (asbestos) Gouverneur 3

C. A. Hartnagel, Albany
- Calcite. Black Cape, Canada 60
- Barite and calcite. Black Cape, Canada 33

Mrs Charles S. Phelps, Canton
- Amphibole (mountain leather) Canton 8

H. S. Peck, Albany
- Calcite (large), New Baltimore 1
- Galena, Ellenville 1

Harvard Museum, Cambridge, Mass.
- Millerite and garnet, Orford, Quebec, Canada 2
- Vesuvianite, Orford, Quebec, Canada 2
- Hodgkinsonite, Franklin Furnace, N. J. 2

R. W. Jones, Albany
- Malachite, Elko county, Nevada 2
- Azurite, Elko county, Nevada 1
- Copper, Elko county, Nevada 1

Exchange

William Carpenter, Butte, Mont.
- Covellite, Leonard mine, Butte, Mont 3
- Enargite, Leonard mine, Butte, Mont 2
- Chalcocite, Leonard mine, Butte, Mont 1
- Bornite, Leonard mine, Butte, Mont 2

Case School of Mines, Cleveland, Ohio
- Celestite, Put-in-Bay, Ohio 1

Collected

D. H. Newland, Albany
- Quartz (scepter crystal), Bedford 1

Purchased

W. A. Bentley, Jerico, Vt.
- Photo prints of forms of water 111

E. S. Law, Schenectady
- Epidote on gneiss, Mayfield 3
- Quartz (crystals), Amsterdam 10
- Garnet in schist, Charlemont, Mass 2
- Gahnite in schist, Charlemont, Mass 1
- Amphibole in schist, Charlemont, Mass 1
- Amphibole (pseudomorph), Charlemont, Mass 1

Charles Ellery, Albany	
Gold in quartz, Weller mine, Telluride, Col	1
Gebhard collection	
Pyrite, Schoharie county	56
Strontianite, Schoharie county	9
Calcite, Schoharie county	1
Barite, Schoharie county	14
Silas Young collection, Warwick	
Graphite, Edenville	2
Graphite, Amity	1
Molybdenite, Mount Eve, Orange county	1
Galena, Ellenville	3
Galena, Guymard	2
Sphalerite, Otisville	1
Sphalerite, Ellenville	3
Covellite, Ellenville	1
Chalcopyrite, Ellenville	2
Chalcopyrite, Otisville	1
Pyrite, Edenville	1
Pyrite, Schoharie	1
Löllingite, Edenville	1
Fluorite, Amity	2
Fluorite, Muscolonge Lake	1
Yttrocerite, Edenville	6
Quartz, Edenville	4
Quartz, Ellenville	3
Quartz, Otisville	2
Quartz, Little Falls	180
Quartz (basonite), Edenville	2
Hematite, Antwerp	1
Ilmenite, Amity	9
Spinel, Amity	27
Spinel, Edenville	15
Magnetite (jenkinsite), Monroe	3
Magnetite, Brewsters	1
Rutile, Edenville	1
Limonite, Staten Island	2
Limonite, Amity	2
Calcite, Lockport	3
Calcite, Rossie	1
Calcite, Pitcairn	1
Calcite, Amity	3
Calcite (tufa), Schoharie county	1
Calcite (satin spar), St Lawrence county	1
Siderite, Antwerp	1
Azurite, Amity	1
Orthoclase, Edenville	1
Oligoclase, Edenville	3
Labradorite, Edenville	1
Labradorite, Washingtonville	1

Pyroxene, Edenville	10
Wollastonite, Amity	1
Amphibole, Edenville	22
Amphibole (edenite), Edenville	18
Amphibole, Amity	11
Amphibole, Gouverneur	1
Amphibole, Edwards	2
Amphibole, Hastings	1
Garnet, Amity	1
Garnet, Brooklyn	1
Chrysolite, Edenville	1
Anthophyllite, New York City	2
Anthophyllite, Staten Island	1
Wernerite, Edenville	2
Wernerite, Amity	3
Vesuvianite, Amity	1
Zircon, Edenville	1
Epidote, Highland	2
Allanite, Edenville	7
Chondrodite, Brewsters	1
Chrondrodite, Edenville	15
Tourmaline, Edenville	13
Tourmaline, Amity	3
Muscovite, Edenville	3
Biotite, Rossie	2
Biotite, Edenville	2
Phlogopite, Amity	5
Seybertite, Amity	11
Serpentine, Amity	7
Serpentine, Edenville	4
Serpentine, Staten Island	3
Serpentine, Brewsters	1
Serpentine, Newburgh	1
Titanite, Edenville	7
Titanite, Amity	1
Apatite, Edenville	1
Warwickite, Edenville	10
Gypsum, Lockport	1
Sulphur, Sicily	1
Selensulphur, Girgenti, Sicily	2
Tellurium, Keystone Lode, Colo	2
Bismuth, Monroe, Conn	1
Gold, Nevada	1
Silver, Michigan	1
Copper, Cornwall, Pa.	2
Copper, New Haven, Conn	1
Copper, Michigan	2
Realgar, Banat, Hungary	1
Stibnite, California	1
Molybdenite, Ross, Ontario, Canada	1

Molybdenite, Frankfort, Pa.	1
Whitneyite, Houghton, Mich	1
Domeykite, Houghton, Mich	1
Argentite, Virginia City, Nev	1
Petzite, Springdale, Colo	1
Galena, Cumberland, England	1
Galena, Marsdons Diggins, Wis	2
Galena, Galena, Ill	1
Galena, Poor Man's Lode, Idaho	1
Chalcocite, Cheshire, Conn	1
Chalcocite, California	1
Stromeyerite, Beaver Creek, Colo	1
Sphalerite, Derbyshire, England	1
Sphalerite, Friedensville, Pa.	1
Sphalerite, Roxbury, Conn	1
Sphalerite, Franklin, N. J	3
Sphalerite, Hungary	1
Coloradoite, Ballarat, Colo	1
Cinnabar, Napa county, Cal	3
Chalcopyrite, Bristol, Conn	1
Chalcopyrite, North Carolina	1
Linnaeite, Siegen, Westphalia, Germany	1
Pyrite, Franklin, N. J.	1
Pyrite, Roxbury, Conn.	2
Pyrite, Utah	2
Pyrite, Richmond, Mass.	1
Pyrite (nodules), Illinois	1
Arsenopyrite, Roxbury, Conn	1
Greenockite, Franklin, N. J	1
Jamesonite, Cornwall, England	1
Bournonite, Cornwall, England	1
Sylvanite, Dunaven Lode, Colo	1
Proustite, Austin, Nev.	1
Enargite, Colorado	1
Fluorite, Cumberland, England	4
Fluorite, Alston Moor, England	2
Fluorite, Durham, England	1
Fluorite, Saxony	2
Fluorite, Rosiclaire, Ill.	1
Fluorite, Franklin, N. J	1
Cryolite, Ivigtuk, Greenland	2
Atacamite, Atacama, Chili	1
Pachnolite, Ivigtuk, Greenland	2
Quartz, Paterson, N. J	5
Quartz, Roxbury, Conn.	1
Quartz, Cornwall, England	1
Quartz, Cheshire, Conn.	2
Quartz, Cumberland, England	2
Quartz (geodes), Brunces Creek, Ill	4
Quartz, Pikes Peak, Colo	3

Quartz, Moosuk, Conn.	1
Quartz, New Augusta, Ill	2
Quartz, Vernon, N. J	1
Quartz (amethyst), Brazil	1
Quartz (amethyst), Thunder Bay, Ont	3
Quartz (amethyst), Ontario, Canada	1
Quartz (chrysoprase), Kosemitz, Silesia	1
Quartz (phrase), Oppenau, Baden	1
Quartz (chalcedony), Mount Lebanon, Syria	1
Quartz (agatized wood), California	1
Quartz (jasper), India	1
Quartz (agate), Wood Basin, Neb	1
Quartz (agate polished), Brazil	10
Quartz (moss agate), Nevada	2
Quartz (itacolumite), North Carolina	1
Quartz (chalcedony), Florida	2
Quartz (rose), Bavaria	1
Quartz (agate), Brazil	5
Quartz (amethyst), Hungary	1
Quartz, Paterson, N. J	2
Quartz (geode), Missouri	1
Quartz, St Gothard, Switzerland	1
Quartz, Phoenixville, Pa.	1
Quartz, Cumberland, England	1
Quartz, Roxbury, Conn	2
Quartz, Nova Scotia, Canada	1
Quartz (aventurine), Giersdorf, Saxony	1
Quartz, Brazil	2
Opal, Mexico	2
Opal, Hungary	2
Opal (wood opal), Libethen, Hungary	2
Opal (hyalite), British Columbia	1
Opal (semi), Bohemia	1
Opal (semi), Colorado	1
Opal (pitch stone), Meissen, Saxony	2
Opal (hyalite), Auvergne, France	1
Stibiconite, Gold Hill, Nev	2
Cuprite, California	1
Cuprite, Cornwall, Pa	4
Cuprite, Cornwall, England	1
Zincite, Franklin, N. J	10
Corundum, Vernon, N. J	6
Corundum, Franklin, N. J	2
Corundum, Clay Co., N. C	2
Hematite, Elba, Italy	1
Hematite, Spain	2
Hematite, Germany	1
Hematite, Cumberland, England	1
Spinel, Ogdensburg, N. J	2
Gahnite, Bodenmais, Bavaria	1

Magnetite, Chester, Pa	1
Franklinite, Franklin, N. J	19
Hausmannite, Ilmenau, Thuringia	1
Cassiterite, Schlackenwald, Bohemia	2
Cassiterite, Durango, Mexico	1
Rutile, Graves Mountain, Ga	1
Rutile, Magnet Cove, Ark	4
Rutile, Lancaster Co., Pa	1
Octahedrite, Tavatsch, Tyrol	1
Brookite, Magnet Cove, Ark	2
Pyrolusite (dendrite), Pensburg, Pa	1
Diaspore, Chester, Mass.	3
Diaspore, Hungary	1
Göthite, Cheshire, Conn	1
Manganite, Ihlfield, Germany	1
Limonite, Ogdensburg, N. J	3
Limonite, Vernon, N. J	3
Brucite, Texas, Pa	3
Chalcophanite, Ogdensburg, N. J	13
Hydrotalcite, Vernon, N. J	5
Calcite, Joplin, Mo.	1
Calcite, Kewenaw Co., Mich	1
Calcite, Warsaw, Ill.	1
Calcite, India	1
Calcite, Ontario, Canada	1
Calcite, Smithfield, R. I	1
Calcite, Bergen Hill, N. J	3
Calcite, Globe, Ariz.	1
Calcite, Franklin, N. J	2
Calcite, Cumberland, England	1
Calcite, Iceland	2
Calcite (stalactite), Mammoth Cave, Ky	2
Calcite (pistolitic), Carlsbad, Germany	2
Calcite, Zacatecas, Mexico	1
Calcite (polished stalactite), California	1
Calcite (stalactite), Iowa	1
Calcite (stalactite), Bermuda	2
Calcite (oolitic), England	1
Dolomite, Cumberland, England	1
Dolomite, Connecticut	1
Dolomite (gurhofite), Montville, N. J	1
Magnesite, Tyrol	1
Magnesite, Texas, Pa.	1
Siderite, Alston Moor, Eng	1
Siderite, Ivigtuk, Greenland	1
Siderite, Germany	1
Rhodochrosite, Franklin, N. J	4
Rhodochrosite, Cornwall, England	1
Smithsonite, Mineral Point, Wis	1
Smithsonite, Ogdensburg, N. J	4

Aragonite, Cumberland, England	3
Aragonite, Columbia, Pa.	1
Aragonite, Girgenti, Sicily	1
Aragonite (flos ferri), Austria	2
Bromlite, Cumberland, England	1
Witherite, Cumberland, England	1
Strontianite, Argyleshire, Scotland	1
Cerussite, Ems, Germany	1
Barytocalcite, Hartz, Germany	1
Malachite, Cheshire, Conn	3
Malachite, Bembe, West Africa	1
Azurite, Chessy, France	1
Azurite, Cornwall, Pa.	1
Azurite, Australia	1
Hydrozincite, Ogdensburg, N. J	2
Zaratite, Texas, Pa.	1
Petalite, Bolton, Mass	1
Orthoclase, Drachenfels, Bonn, Germany	1
Orthoclase, Ontario, Canada	1
Microcline, Pikes Peak, Colo	5
Microcline, Franklin, N. J	4
Microcline (graphic granite), Hadden, Conn	1
Microcline, Rockport, Mass.	1
Albite, St Gothard, Switzerland	1
Albite, Zillerthal, Tyrol	1
Albite, Perth, Canada	1
Albite, Middletown, Conn.	2
Oligoclase, Middletown, Conn.	1
Oligoclase, Medea, Pa.	1
Oligoclase (moonstone), Mineral Hill, Pa	1
Labradorite, Labrador	1
Hypersthene, Buckston, Me	2
Pyroxene, Ogdensburg, N. J	8
Pyroxene, Tyrol	1
Spodumene, Rumford, Me.	1
Spodumene, Chesterfield, Mass.	1
Pectolite, Bergen Hill, N. J	3
Rhodonite, Franklin, N. J	10
Rhodonite, Cranston, R. I	1
Anthrophyllite, Burlington, Conn	1
Amphibole, Russell, Mass.	1
Amphibole, Zillerthal, Tyrol	1
Amphibole, Ogdensburg, N. J	3
Amphibole, Young county, N. C.	1
Amphibole, New Hampshire	1
Amphibole (cummingtonite), Polk co., Tenn	1
Beryl, Germany	1
Beryl, Tyrol	1
Beryl, Haddam, Conn.	1
Beryl, Norway, Me.	1

Beryl, Leperville, Pa.	1
Iolite, Haddam, Conn.	1
Iolite (fahlunite), Fahlum, Sweden	1
Nephelite, Litchfield, Me.	1
Nephelite, Mount Somma, Sicily	1
Cancrinite, Litchfield, Me.	2
Cancrinite, Gardner, Me.	1
Sodalite, Kicking Horse Pass, B. C	1
Haüynite, Laachen See, Eifel, Germany	1
Danalite, Rockport, Mass.	1
Garnet, Franklin, N. J	10
Garnet, Hamburg, N. J	1
Garnet, Ogdensburg, N. J	3
Garnet, Warren, N. H	2
Garnet, Monroe, Conn.	1
Garnet, Gatineau, Canada	2
Garnet, Leperville, Pa.	1
Garnet, Orford, Quebec	1
Garnet, Silverberg, Baden, Germany	1
Garnet, Reading, Conn.	1
Chrysolite, Eifel, Germany	1
Willemite, Franklin, N. J	12
Wernerite, Bathhurst, Canada	1
Vesuvianite, Eker, Norway	1
Vesuvianite, Sanford, Me.	1
Topaz, Monroe, Conn.	1
Topaz, Thomas Range, Utah	1
Topaz, San Luis Potosi, Mexico	33
Topaz, Brazil	4
Andalusite, Lancaster, Mass.	6
Sillimanite, Norwich, Conn	1
Cyanite, New Britain, Conn	1
Cyanite, Barkhamsted, Conn	1
Cyanite, Bethesda, Pa.	1
Datolite, Roaring Brook, Conn	1
Datolite, Bergen Hill, N. J	2
Datolite, Ontonagon county, Mich	1
Zoisite, Tyrol	1
Epidote, Willimantic, Conn.	3
Epidote, Lake Superior, Mich	1
Epidote, Untersulzbachthal, Tyrol	1
Hancockite, Franklin, N. J	2
Axinite, Dauphiny, France	1
Prehnite, Paterson, N. J	20
Chondrodite, Sparta, N. J	1
Cerite, Bastnas, Sweden	1
Calamine, Ogdensburg, N. J	34
Tourmaline, Rumford, Me.	4
Tourmaline, Hamburg, N. J	1
Tourmaline, Franklin, N. J	2

Tourmaline, Middletown, Conn.	1
Tourmaline, Paris, Me.	1
Tourmaline, Chesterfield, Mass.	1
Staurolite, North Carolina	5
Staurolite, Fanning county, Ga	4
Staurolite, Lisbon, N. H	1
Apophyllite, Bergen Hill, N. J	1
Apophyllite, Paterson, N. J	1
Heulandite, Paterson, N. J	5
Heulandite, Nova Scotia	2
Stilbite, Nova Scotia	1
Stilbite, Frankford, Pa.	1
Stilbite, Ontonagon county, Mich	1
Stilbite, Paterson, N. J	2
Gismondite, Mount Vesuvius, Italy	1
Laumontite, Paterson, N. J	2
Chabazite, Wasson's Bluff, N. S	1
Chabazite, Jones Falls, Md	1
Chabazite, Nova Scotia	1
Analcite, Seisson Alp, Tyrol	1
Analcite, Bergen Hill, N. J	2
Analcite, Keweenaw county, Mich	1
Analcite, Jalisco, Mexico	1
Natrolite, Paterson, N. J	2
Mesolite, Giant's Causeway, Ireland	1
Thomsonite, Paterson, N. J	1
Thomsonite (faroelite), Faroe islands	1
Muscovite, Fairville, Pa.	1
Muscovite, Mount Airy, N. C	1
Muscovite, Trumbull, Conn.	1
Muscovite, Pennsborough, Pa.	1
Muscovite, Stoneham, Me.	2
Lepidolite, Middletown, Conn.	1
Lepidolite, Bogna, Moravia	1
Lepidolite, Saxony, Germany	1
Lepidolite, Paris, Me.	1
Lepidolite, Hebron, Me.	1
Phlogopite, South Burgess, Canada	1
Lepidomelane, Litchfield, Me.	1
Roscoelite, Kekomo, Colo	1
Margarite, Chester, Mass	1
Chlorotoid, Warwick, R. I	1
Clinochlore, Lerni, Pa.	1
Clinochlore, Bermingham, Pa.	1
Penninite (pseudophite), Markirch, Alsace	1
Jefferisite, High Bridge, N. J	1
Protovermiculite, Magnet Cove, Ark	1
Caswellite, Franklin, N. J	2
Serpentine, New Haven, Conn	1
Serpentine, Vernon, N. J	5
Serpentine, Montville, N. J	8

Serpentine, Franklin, N. J	2
Serpentine, Easton, Pa.	1
Serpentine (williamsite), Cornwall, Pa	1
Serpentine (bowenite), Smithfield, R. I	1
Serpentine (williamsite), Texas, Pa	1
Serpentine (baltimorite), Texas, Pa	1
Serpentine, Cornwall, England	1
Deweylite, Maryland	1
Talc, Chester, Mass.	2
Talc, Upper Egypt	2
Thaumasite, Paterson, N. J	1
Catlinite, South Dakota	1
Chrysocolla, Cornwall, Pa.	7
Chrysocolla, Heckle Mine, Idaho	1
Titanite, Vernon, N. J	1
Titanite, Renfrew county, Canada	3
Astrophyllite, Larnoe, Norway	1
Pyrophyllite, Orange county, N. C	1
Fergusonite, Ytterby, Sweden	1
Columbite, Middletown, Conn	1
Columbite, Rumford, Me	1
Yttrotantalite, Ytterby, Sweden	1
Triphyllite, Bavaria	1
Beryllonite, Stoneham, Me	1
Apatite, Renfrew county, Canada	4
Apatite, Spain	1
Pyromorphite, Ems, Nassau, Germany	3
Pyromorphite, Phoenixville, Pa	1
Amblygonite, Hebron, Me	1
Olivinite, Cornwall, England	2
Vivianite, Mullica Hill, N. J	3
Varisite, Montgomery county, Ark	1
Varisite, Garland county, Ark	1
Wavellite, Garland county, Ark	3
Wavellite, Bohemia	1
Wavellite, White House, Pa	1
Pharmacosiderite, Cornwall, England	1
Childrenite, Cornwall, England	1
Beudantite, Dembach, Nassau, Germany	1
Boracite, Holstein, Germany	1
Borax, California	1
Uraninite, Flat Rock, N. C	1
Barite, Nova Scotia	1
Barite, Alston Moor, England	1
Barite, Cheshire, Conn	2
Celestite, Girgenti, Sicily	5
Anglesite, Phoenixville, Pa	1
Anhydrite, Stassfurt, Germany	1
Anhydrite, Wurtemburg, Germany	1
Gypsum, Bologna, Italy	1
Gypsum (fibrous), Wales, England	2

Gypsum (alabaster), New Brunswick, Canada	1
Cyanotrichite, La Garonne, France	1
Wolframite, Zinnwald, Saxony	1
Scheelite, Zinnwald, Saxony	1
Wulfenite, Tacoma mine, Nev	2
Wulfenite, Southampton, Mass	1
Succinite, Baltic sea, Germany	1
Albertite, Nova Scotia	1
Jet, Whitby, England	1
Ward's Natural Science Establishment, Rochester	
Tourmaline, Misa Grande, Cal	4
	1544

PALEONTOLOGY

Donation

Brown, Thomas C. Bryn Mawr, Pa.
Callograptus grabaui Hahn, from Spring Creek formation, Spring Creek near Bellefonte, Pa 1

Buehler, Dr H. A. Rolla, Mo.
Oriskany fossils from St Genevieve county, Mo 8

Foerste, Dr Aug. F. Dayton, Ohio
Large spine of eurypterid from the Utica shales near Rome, N. Y. 1

Gilbert, Frank. Albany
Grammysia hamiltonenis, from Indian Fields, Albany county 1

Hudson, Prof. George H. Plattsburg
Types of Blastoidocrinus carchariaedens Billings (sp.) used in Museum Bulletin 107 12

McMaster, J. Glens Falls
Trilobite from Amsterdam limestone, Glens Falls 1

Schuchert, Dr Charles. New Haven, Conn.
Dictyonema from basal Ordovicic, Navy Island, St John, N. B., Canada 9

Purchase

Gebhard, W. D. Schoharie, N. Y.
Fossils from the following formations in Schoharie county:

Hamilton	260
Agoniatites limestone	58
Onondaga limestone	530
Schoharie grit	1430
Oriskany sandstone	1260
Becraft limestone	18
New Scotland limestone	1195
Coeymans limestone	670
Manlius limestone	298
Cobleskill limestone	294

Total 6013

Kinnear, W. T. Kirkbuddo, Forfar, Scotland
Birkenia elegans Traq. Upper Siluric, Seggholm, Muirkirk, Ayr, Scotland 1
Thelodus scoticus Traq. Seggholm, Muirkirk, Ayr, Scotland 2
Tealliocaris londonensis Peach. Scottish Calciferous sandstone, Lower Carboniferous England 1

Krantz, Dr F. Bonn, Germany
Foreign Cambric fossils 24

Collection

Burmaster, E. R. Irving
Upper jaw of bison from Indian grave near Irving, N. Y 1

Luther, D. D. Naples
Devonic fossils (mostly from Cashaqua beds) from western New York 101

Hartnagel, C. A. Albany
Fossils from the Siluric section on north side of the Bay of Chaleur, in the vicinity of Black Cape, P. Q., Canada 300
Fossils from the Siluric section on south side of the Bay of Chaleur at Petite Roche, New Brunswick, Canada 20
Fossils from Siluric section at Limestone Point, 2 miles north from Petite Roche, New Brunswick, Canada 10

ENTOMOLOGY

Donation

Hymenoptera

Goodyear, Charles. Tarrytown. Vespa crabro Linn., European hornet, adult and work on birch twig, December 16, January 14

Jeffries, F. M. New York City. Through State Department of Agriculture. Same as preceding, work on white birch, August 26

Moore, Albert. Mount Kisco. Isosoma orchidearum Westw., Cattleya or orchid Isosoma, infested buds, larvae, pupae and adults on Cattleya, July 2

Phelps, Vincent. Newburgh. Aphelinus fuscipennis How., San José scale parasite, December 5

Albright, M. C. Salisbury, Md. Same as preceding, infesting San José scale on Symphoricarpos, December 8

Kingman, Frank. Schodack. Same as preceding, on San José scale, December. Also Prospaltella perniciosi Tower, on San José scale, December

Budd, Mrs John. Schodack. Same as preceding

Masten, Dr Edward. Schodack. Same as preceding

Niles, F. T. Mamaroneck. Same as preceding

Guernsey, W. A. Saratoga Springs. Megarhyssa atrata Fabr., black long sting, adult on maple, June 13

Bailey, Mrs E. J. Coeymans. M. lunator Fabr., lunate long sting, adult, August 6

Gardner, Mrs E. P. Canandaigua. Rhodites rosaelfolii Ckll., lenticular rose gall, on Rosa blanda, September 8. Also R. globuloides Beutm., globose rose gall; R. dichlocerus Harr., long rose gall

Bethel, E. Denver Col. Aylax pisum Walsh, galls on Lygodesmia juncea, October 15

Burnham, S. H. Hudson Falls. Diastrophus fusiformans Ashm., gall on blackberry, September

de Vyver, J. James. Mount Vernon. D. nebulosus O. S., adults and galls on blackberry, May 5

Walker, R. S. Chattanooga, Tenn. Callirhytis cornigera O. S., gall on Quercus palustris, May 20

de Vyver, J. James. Mount Vernon. C. punctata Bass., knotty oak gall, adults and galls on Quercus, May 5

Berby, J. A. and **Parker, H. L.** Clemson College, S. C. C. palustris O. S., galls, April 30. Also C. seminator Harr., wool sower gall, galls on Quercus; Amphibolips confluens Harr., oak apple gall, galls on Quercus; A. inanis O. S., empty oak apple, galls on Quercus; Holcaspis globulus Fitch, bullet gall, galls on Quercus

Bethel, E. San José, Cal. Dryophanta echinus O. S., galls on Quercus agrifolia, August 23

de Vyver, J. James. Mount Vernon. Neuroterus noxiosus Bass., noxious oak gall, adults and young, on Quercus, May 5

Sherwood, J. W. Spring Valley. Same as preceding, galls and adult on Quercus, July 10

Rice, W. C. Birch Island, Upper Saranac. Through State Conservation Commission. Hylotoma pectoralis Leach, larvae on white birch

Carbary, H. J. Childwold. Pteronus integer Say, currant stem borer, larvae on currant, August 6

Sands, H. C. Lynbrook. P. ventralis Say, yellow-spotted willow slug, larvae on willow, August

Butler, A. W. Mount Kisco. Lophyrus abbotii Leach, Abbott's pine sawfly, larvae on pine, September 30

Coleoptera

Newman, G. W. Waverly. Dendroctonus terebrans Oliv., turpentine bark beetle, workings in pine, June 4

Levison, J. J. Brooklyn. Phloeosinus dentatus Say, red cedar bark beetle, larvae and work on red cedar, June 15, also adults and work, September 8

de Vyver, J. James. Mount Vernon. Xyleborus celsus Eich., Ambrosia beetle, adult on hickory, May 5

Pomeroy, F. Cooperstown. Cryptorhynchus lapathi Linn., mottled willow and poplar curculio, on poplar, July 11

Van Fredenberg, H. A. Port Jervis. Pomphopoea sayi Lec., Say's blister beetle, adult, June 8

Wiltsie, A. J. Feura Bush. Same as preceding, June 13

Seeber, C. Canajoharie. Same as preceding

Ritter, Miss Hazel C. Little Falls. Same as preceding, adults on locust, June 13

Feily, J. H. Rensselaer. Same as preceding, adults destroying bean blossoms, June 17

de Vyver, J. James. Mount Vernon. Nyctobates pennsylvanica De G., adult on hickory, May 5

Stout, A. B. New York City. Bruchus hibisci Oliv., in seeds of Hibiscus militaris, January 13

Hubbard, G. C. Red Hook. Galerucella luteola Müll., elm leaf beetle, adult, May 11

Marshall, C. C. Millbrook. Same as preceding, May 18

Merritt, Mrs Douglas. Rhinebeck. Same as preceding, May 25

Tate, L. A. Gloversville. Same as preceding, adults and eggs on elm, June 5

Blackman, H. W. Syracuse. Same as preceding, eggs and larvae on elm, June 12

Hammond, Benjamin. Illinois. Diabrotica duodecimpunctata Oliv., 12-spotted Diabrotica, September 11

de Vyver, J. James. Mount Vernon. Gastroidea cyanea Melsh., adults, May 5

Crittenden, Mrs W. H. Cornwall. Nodonota puncticollis Say, adults on rose, June 16

Griffith, L. C. Lynbrook. Through State Department of Agriculture. Typophorus canellus Fabr., strawberry root worm, work on strawberry, August

Hunter, David. San Antonio, Texas. Fidia cana Horn, adult on grape, May 16

Slade, M. P. Mount Kisco. Saperda calcarata Say, poplar borer, larva and work on Lombardy poplar April 24

de Vyver, J. James. Mount Vernon. Graphisurus fasciatus DeG., on hickory, June 22. Also Hetoemis cinerea Oliv., on mulberry, June 22

Kelly, William. Blue Mountain Lake. Monohammus confusor Kirby, sawyer, on balsam, July 20

Armstrong, A. C. Warner. Elaphidion villosum Fabr., maple and oak twig pruner, larvae and work on hickory, June 2

Rosenbaum, F. G. New York City. Same as preceding, grubs and work on oak, July 3

Davies, W. D. New York City. Same as preceding, July 7

Goodwin, A. S. New York City. Same as preceding, July 8

Moore, H. P. White Plains. Same as preceding, July 13

Gordinier, H. W. & Sons. Troy. Same as preceding, larvae on oak, July 21

Carpenter, C. K. New York City. Same as preceding, July 24

Blackburn, Mrs John T. D. Crater Club, Essex County. Same as preceding, July 24

Chipp, R. D. Nyack. Same as preceding, July 30

Lansing, Miss Gertrude. Ogunquit, Me. Callidium antennatum Newm., blue pine borer, on spruce, June 26

Taylor, J. M. Albany. Osmoderma ? scabra Beauv., rough flower bettle, larvae at base of decaying oak posts, October 14

de Vyver, J. James. Bronxville. Ligyrus relictus Say, June. Also Lachnosterna arcuata Sm.; L. barda Horn; L. fusca Froh.; L. micans Knoch.; L. hirticula Knoch.; L. fraterna Harr.; L. crenulata Froh.

Lacey, F. H. Boston Corners. L. dubia Sm., June 10

Latham, Roy. Orient. Same as preceding, adult, June 25. Also L. fusca Froh.; L. hirticula Knoch.; L. tristis Fabr.

Tucker, Gilbert. Altamont. L. fusca Froh., June beetle, May 19

Marshall, D. T. Hollis. L. micans Knoch., May 22. Also L. fraterna Harr.

Lacey, F. H. Boston Corners. Same as preceding, adult, June 19

Davis, J. J. Lafayette, Ind. L. crassissima Blanch., L. implicita Horn, L. vehemens Horn, L. arcuata Sm., L. hirticula Knoch., L. gibbosa Burm., L. inversa Horn, L. bipartita Horn, L. congrua Lec., L. torta Lec., L. affinis Lec., L. crenulata Froh., January 28

Marshall, D. T. Hollis, L. I. Diplotaxis tristis Kirby, May 22

de Vyver, J. James. Bronxville. Same as preceding, June

Le Brun, G. P. Far Rockaway. Macrodactylus subspinosus Fabr., rose chafer, adults on peaches, June 16

Tucker, G. M. jr. Glenmont. Same as preceding, adults destroying strawberries, June 17

Sihairer, George. Scotia. Same as preceding, adults, June 21

Riddell, Samuel. Huntington. Serica iricolor Say, adult on oak, June 3

Latham, Roy. Orient. S. sericea Ill., adult, June 25

Von Schrenk, Hermann. St Louis, Mo. Lyctus planicollis Lec., powder post beetle, adults on ash, March 12

Cogswell, G. E. Jamaica. L. opaculus Lec., powder post beetle, adults, May 23

Branion, H. A. Chatham. Sitodrepa panicea Linn., drug store beetle, adult, June 19

Cole, T. L. Catskill. Chauliognathus pennsylvanicus De G., adult, September 3

Levison, J. J. Brooklyn. Agrilus bilineatus Web., two-lined chestnut borer, work in oak, November 24. Also A. anxius Gory, bronze birch borer, work on black birch, September 9

Peck, N. C. Hartsdale. A. otiosus Say, work on dogwood, March 9

Baldwin, E. A. Schenectady. Glischrochilus quadriguttatus Fabr., adults on melon plant, July 20

Armer, H. N. Kingston. Attagenus piceus Oliv., black carpet beetle, adults, May 7

Harrison, David. Staatsburg. Staphylinus maculosus Grav., rove beetle, adult, March 6

Diptera

Cox, Townsend jr. Setauket. Culex subcantans Felt, adult, July 7

State Department of Agriculture. Fisher's Island. Cecidomyia serotinae O. S., gall on wild cherry, January 19

Burnham, S. H. Hudson Falls. Cecidomyia sp., gall on Laportea cañadensis, July 6. Also Itonida foliora Rssl. & Hkr., gall on Quercus, September

Latham, Roy. Orient. Obolodiplosis robiniae Hald., gall on Robinia, August 25

Mac Gregor, E. A. Mound, La. Arthrocnodax carolina Felt, May 25

Bethel, E. Denver, Col. Hormomyia crataegifolia Felt, gall on Crataegus coloradensis, July 7

Burnham, S. H. Hudson Falls. Caryomyia caryae O. S., gall on Carya, September

Cösens, A. Toronto, Can. ? Contarinia negundifolia Felt, galls on Acer negunda, July 12. Also Phytophaga rigidae O. S., galls on willow, April 29; Oligotrophus salicifolius Felt, galls on Salix humilis, July 12

Bethel, E. Burlingame, Cal. Thecodiplosis pini-radiatae Snow & Mills, galls on Pinus radiata, August 23. Also from Denver, Col., Rhopalomyia betheliana Ckll., galls on Artemisia filifolia, October 15

Kellogg, V. L. Stanford University, Cal. Thecodiplosis pini-radiatae Snow & Mills, September 18

Latham, Roy. Orient. Cincticornia pilulae Walsh, gall on Quercus, September 22. Also Rhopalomyia anthophila O. S., gall on Solidago, September 22; R. racemicola O. S.; Sackenomyia viburnifolia Felt, gall on Viburnum; Oligotrophus salicifolius Felt; Lasioptera farinosa Beutm., gall on Rubus; L. lycopi Felt, gall on Lycopus; Neolasioptera erigerontis Felt, gall on Erigeron, June 25; Cystiphora canadensis Felt, gall on Prenanthes, August 25

Burnham, S. H. Hudson Falls. Rhopalomyia solidaginis Lw., gall on Solidago, September. Also Lasioptera corni Felt, gall on Cornus; Neolasioptera clematidis Felt, gall on Clematis; Dasyneura communis Felt; Rhabdophaga salicifolia Felt; Winnertzia hudsonica Felt

Gardner, Mrs E. P. Canandaigua. Lasioptera desmodii Felt, gall on Canadian tick trefoil, September 8

Seeger, Mrs Charles L. Patterson. Dasyneura communis Felt, galls on maple, June 18

Stene, A. E. Kingston, R. I. D. parthenocissi Steb., gall on woodbine, June 26

Theobald, F. V. Wye, Kent, England. D. pyri Bouché., pear leaf-curling midge, adults on pear, November

Hewitt, C. G. Ottawa, Can. D. rodophaga Coq., larvae on rose, August 10

Britton, W. E. Essex, Conn. Rhabdophaga salicifolia Felt, gall on hardhack, August 18

Malloch, J. R. Havana, Ill. Agromyza aristata Malloch & Hart, paratype, May 11

Bradley, Miss Helen E. Cato. Eristalis tenax Linn., drone fly, rat-tail larva from stock well, September 18

Greene, Mrs Horace L. Fort Plain. Scenopinus fenestralis Linn., carpet fly, larva under carpet, February 7

Lepidoptera

Hodges, C. C. Utica. Papilio troilus Linn., green-clouded swallow-tail, larva on Benzoin odoriferum, September 28

Bradley, Miss Helen E. Cato. Eurymus philodice Godart, adults, September 18

Brackett, E. T. Saratoga Springs. Euvanessa antiopa Linn., spiny elm caterpillar, larvae, June 10

Wadsworth, Austin. Geneseo. Through State Department of Agriculture. Same as preceding, larvae on elm, June 12

Thomas, J. M. Yonkers. Same as preceding, adult, August 11

Marshall, D. T. Hollis, L. I. Sphecodina abbotii Swain, Abbott's sphinx, larvae on grape, July 24

Woodward, A. J. Hadley. Same as preceding, adult, July 31

Briggs, C. M. Chicago, Ill. Through J. Eyer. Pholus achemon Dru., larva, July 21

Peck, C. H. Menands. Paonias myops Sm. & Abb., adult, June 24

Whaley, F. J. Rensselaerville. Halisidota caryae Harr., adult on maple, August 8

Van Orden, Mrs C. H. Catskill. Macronoctua onusta Grt., larvae on Iris, August 12

Audubon, M. R. Salem. Agrotis scandens Riley, climbing cut-worm, larvae on corn, June 25

Howard, G. C. Garden City. Through Doubleday, Page & Co. Mamestra picta Harr., zebra caterpillar, larva on Japanese Iris, July 14

Marshall, D. T. Hollis, L. I. Heliophila unipuncta Haw., army worm, larvae on grasses, July 18

Travell, Howard. New York City. Same as preceding, adult, September 2

Jausen, E. B. Kingston. Xylina antennata Walk., green fruit worm, adults, March 31, April 1 and 18

Tate, L. A. Gloversville. Same as preceding, June 5

Wadsworth, Austin. Geneseo. Through State Department of Agriculture. Same as preceding, larvae on elm, June 12

Ogden, A. T. Kinderhook. Heliothis armiger Hübn., cutworm, larvae on corn, July 30

Ganong, F. J. Crafts. Same as preceding, larva and work on corn, October 29

Chipp, R. D. Nyack. Same as preceding, larvae on corn, August 12

Huested, P. L. Blauvelt. Through M. M. Kennedy. Abrostola triplasia Linn., dark spectacle, pupa on Magnolia, March 20

Baxter, M. S. Rochester. Alabama argillacea Hübn., cotton moth, adults, September 25 and October 20

Laney, C. C. Rochester. Same as preceding, adults, September 25

Wade, T. J. New Rochelle. Datana integerrima Grt. & Rob., black walnut caterpillar, exuviae on black walnut, August 24

State Department of Agriculture. Fisher's Island. Euproctis chrysorrhoea Linn., brown-tail moth, winter nests, January 2

Van Patten, S. B. Union. Malacosoma americana Fabr., apple tent caterpillar, eggs on apple, January 31

Lyon, E. Katonah. Same as preceding, March 4

Barron, Leonard. Garden City. Same as preceding, larvae, May 5

Van Clefe, J. O. Oakdale, L. I. Same as preceding, larvae and tent, May 18

Tate, L. A. Gloversville. Same as preceding, adult, June 5

Lodge, W. S. Chilson Lake. Same as preceding, cocoon, July 15

Hicks, J. J. Jericho, L. I. Same as preceding, egg masses, August 31

Blunt, Miss Eliza S. New Russia. M. disstria Hübn., forest tent caterpillar, larvae, May 28

Wadsworth, Austin. Geneseo. Through State Department of Agriculture. Same as preceding, larvae on elm, June 12

Nichols, J. W. Saratoga Springs. Same as preceding, adults, June 16

Riley, J. E. Through State Conservation Commission. Same as preceding, cocoon on pine, June 17

Winthrop, Beekman. New York City. Same as preceding, cocoons and cast skins, June 18

Blunt, Miss Eliza S. New Russia. Same as preceding, cocoons and old egg belts, June 20

Leavitt, J. L. Russell. Same as preceding, larvae and cocoons, July 1

Owens, Frank. Horicon. Same as preceding, larvae and cocoons, July 3

Janack, John jr. Wanakena. Same as preceding, larvae, July 4

Witherbee, F. S. Port Henry. Same as preceding, cocoons, July 7

Ahearn, Michael. Clayburgh. Same as preceding

Phelps, C. A. Canton. Same as preceding, cocoons, July 15

Smith, Mrs C. McClellan. Cambridge. Same as preceding, exuviae on sugar maple, September 8

Morey, C. L. Greenwich. Paleacrita vernata Peck, spring canker worm, June 7. Also Erannis tiliaria Harr., 10-lined inch worm

de Vyver, J. James. Mount Vernon. Same as preceding, work, June 22

Horner, H. H. Albany. Eustroma diversilineata Hübn., larvae on woodbine, June

Latham, Roy. Orient. Cingilia catenaria Dru., September 22

Dodge, J. H. Nebraska. Thyridopteryx ephemeraeformis Haw., bagworm, bag on apple, March 26

Millers Nursery. South Jamaica. Through State Department of Agriculture. Same as preceding, on Styrax, August 4, 12

George, Miss Margaret. Yonkers. Sibine stimulea Clem., saddleback caterpillar, larva on oak, October 16

Griffith, L. C. Lynbrook. Through State Department of Agriculture. Prolimacodes scapha Harr., Skiff Limacodes, larvae on flowering crabapple, October 6

Goodyear, Charles. Tarrytown. Zeuzera pyrina Linn., leopard moth on apple, December 16

Mager, C. E. New York City. Same as preceding, work on linden, September 11

Braucher, R. W. Western Maryland. Prionoxystus robiniae Peck, larva, July 20

Seaver, F. J. New York City. Podosesia syringae Harr., ash borer, adult, larvae and exuviae on ash, October 5

Zimmer, C. H. Lynbrook. Through State Department of Agriculture. Phlyctaenia ferrugalis Hübn., greenhouse leaf-tyer, adults on chrysanthemum, December 2

Burnham, S. H. Hudson Falls. Same as preceding, larva on marsh field fern, June 19

Lacy, F. H. Millerton. Crambus caliginosellus Clem., sooty Crambus, larvae on corn, June 12

Pulver, H. W. Pine Plains. Same as preceding, larva, June 24

Conklin, E. W. Salt Point. Same as preceding, larvae on corn, July 6

Clark, S. J. Mount Vernon. Dioryctria reniculella Grote, spruce cone worm, larvae in spruce cones, July 8

Livingston, J. H. Tivoli. Tmetocera ocellana Schiff., bud moth on cherry buds, April 8

Bradford, W. H. Ellenville. Archips cerasivorana Fitch, ugly nest cherry worm, larvae, July 7

Callan, A. S. Chatham. Same as preceding, adults, July 7

Waterman, Alfred. Twaddell Point Station, East Branch. A. fervidana Clem., larvae on oak, July 14

Harris, S. G. Tarrytown. Tortrix fumiferana Clem., spruce bud worm, pupae on spruce, June 1

Whitinger, Mrs E. C. Schenectady. Same as preceding, larvae on spruce, June 3

Stoneman, W. G. Albany. Same as preceding, larvae on blue spruce, June 4

Patch, Miss Edith M. Orono, Me. Same as preceding, pupae in hemlock and balsam, June 25

Parmelee, Robert. Oswegatchie. Same as preceding, larvae on spruce, July 7

Hicks, Isaac & Son. Westbury. Dichomeris marginellus Fabr., Juniper webworm, cocoon and work on Swedish Juniper, December 15

Merkel, H. W. New York City. Same as preceding, larva on Juniper, April 11

de Vyver, J. James. Mount Vernon. Coleophora limosipennella Dup., elm case-bearer, larvae on elm, June 22

Kurz, G. M. Oyster Bay, L. I. Same as preceding, July 22

de Vyver, J. James. Mount Vernon. C. fletcherella Fern., cigar case-bearer, larvae on elm, June 22

Platyptera

Van Bergen, Irving. Schoharie. Corydalis cornuta Linn., Dobson fly, larvae, June 3

Morehouse, Mrs H. C. Howes Cave. Same as preceding, adult, June 26

Ephemeridae

Alexander, C. P. Northampton. Baetisca obesa Say, larvae, May 24. Also Siphlonisca aerodromia Ndh., Mayfly, larvae, May 24

Horton, Theodore. Albany. Cleon sp., larvae from water supply, December 8

Hemiptera

Rose, J. F. South Byron. Cicada linnei Grossb., August 16

Bahnsen, C. Lake Placid. ? Ormenis pruinosa Say, lightning leaf hopper, young on wild cherry, July 14

Smith, J. H. Chestertown. Aphrophora parallela Say, parallel spittle insect, nymphs on pine, July 3

Van Duzee, E. P. La Jolla, Cal. Bythoscopus franciscanus Baker, June 21. Also Thamnotettix heidemanni Ball, June 21

Lawrence, C. C. Newburgh. Through Frost & Bartlett Co. Alebra albostriella Fall., on Norway maple, July 16

Bethel, E. Denver, Col. Pachypsylla venusta O. S., gall on Celtis reticulata, December 1

Hays, Miss A. K. South Nyack. Phylloxera caryaecaulis Fitch, hickory gall aphid, gall, June 23

Frost & Bartlett Co. Stamford, Conn. Same as preceding, July 2

Openhyme, Mrs. St Huberts. Through State Department of Agriculture. Chermes floccus Patch on spruce, December 16

Goodyear, Charles. Tarrytown. C. abietis Linn., spruce gall aphid on spruce, January 14

Dummett, Arthur. Mount Vernon. Same as preceding, August 6

Barrus, G. L. Lake Placid Club, Essex County. Same as preceding, September 2

Luke, Walter. New York City. C. strobilobius Kalt., woolly larch aphis, eggs on pine, May 4

Seaver, A. J. New York City. Same as preceding, eggs and young on larch, May 5

Nill, John. Watertown. C. cooleyi Gill., aphid spruce gall, gall on spruce, July 7

Foord, A. G. Kerhonkson. C. pinicorticis Fitch, pine bark aphid, adults and young on white pine, May 3

Wade, T. J. New Rochelle. Pemphigus populi-globuli Fitch, galls on Lombardy poplar, June 18

Lyon, Edwin. Katonah. Colopha ulmicola Fitch, cockscomb elm gall, galls on elm, July 1

Tate, L. A. Gloversville. Schizoneura lanigera Hausm., woolly aphis on elm leaves, June 5

Livingston, J. H. Tivoli. Same as preceding, June 9

Judson, J. D. Vernon. Same as preceding, June 10

Blunt, Miss Eliza S. New Russia. Same as preceding, adults and young on elm leaves, June 20

Hereford, Miss Alice C. Watertown. Same as preceding, June 22

Howell, W. W. Poughkeepsie. Same as preceding, adult on slippery elm, June 23

Greene, Mrs Horace L. Fort Plain. Same as preceding, July 5

Naramore & Young. Rochester. Phyllaphis fagi Linn., woolly beech leaf aphis, adults and young on beech, September 19

Becker, Miss Emily F. Catskill. Chaitophorus aceris Linn., Norway maple plant louse, adults on Norway maple, July 9

Naramore, M. J. Ossining. Drepanosiphum acerifolii Thos., on maple, May 25

Nill, John. Watertown. Mindarus abietinus Koch., balsam aphid, work on balsam, July 7

Heilman, J. R. Poughkeepsie. Aphis sorbi Kalt., rosy aphis, adult and young, July 2

Howell, W. W. Poughkeepsie. Myzus cerasi Linn., black cherry aphis, adult on cherry, June 23

Niles, H. W. Mount Kisco. Paraleyrodes mori Quaint., adults on Kalmia, July 3

King, G. B. Lawrence, Mass. Kermes pubescens Bogue, on white oak, May 14. Also K. cockerelli Ehrh., on Quercus kelloggi, May 14; K. nivalis King & Ckll., on Quercus rubra; K. essigii King, on Quercus agrifolia

Witherbee, F. S. Port Henry. Physokermes piceae Schr., spruce bud scale, adults and young on Norway spruce, July 7

Dummett, Arthur. Mount Vernon. Same as preceding, galls on spruce, August 6

House, H. D. Near Oneida, Madison county. Pseudococcus ledi Ckll., scale on Ledum groenlandicum, August

Bunn, E. Yonkers. Pulvinaria vitis Linn., cottony maple scale, adult on grape, May 9

Waterman, Alfred. Twaddell Point Station, East Branch. Same as preceding, egg sacks on maple, July 14

Goodyear, Charles. Tarrytown. Gossyparia spuria Mod., elm bark louse on elm, December 16

Mead, F. L. Mechanicville. Same as preceding, female on elm, June 18

Kurz, G. M. Oyster Bay, L. I. Same as preceding, July 22

Turner, J. D. Kingston. Phenacoccus acericola King, false maple scale, young on sugar maple, April 24

Hammond, Benjamin. Fishkill. Same as preceding, adults on sugar maple, September 2

Cockerell, T. D. A. Los Banos, P. I. Phenacaspis mischocarpi Ckll. & Rob., on Mischocarpus, June 24. Also Protopulvinaria longivalvata bakeri Ckll.

Levison, J. J. Brooklyn. Eulecanium nigrofasciatum Perg., black-banded scale, young scales on Sycamore, December 30

New York Farmer. Port Jervis. Same as preceding, young on sugar maple, November 19

Goodyear, Charles. Tarrytown. E. tarsale Sign., soft scale on dogwood, December 16

Livingston, J. H. Tivoli. E. tulipiferae Cook, tulip tree scale, adults on tulip tree, July 30

Wheeler, Dr W. M. San Lucas Toliman, Guatemala. Neolecanium sallei Sign., Lecanium scale, adult on Erythrina sp., February

Griffith, L. C. Lynbrook. Icerya purchasi Mask., cottony cushion scale, adults and young on Acacia, October 23

Levison, J. J. Brooklyn. Chionaspis americana Johns., scurfy elm scale, eggs on elm, October 17

Hicks Nurseries. Westbury. Same as preceding, eggs on Ulmus americana, November 7. Also C. corni Cooley, on Cornus, December 5

Goodyear, Charles. Tarrytown. Same as preceding, on elm, December 16

Kraisman, D. Brooklyn. Same as preceding, June 2

Whaley, F. J. Albany. Same as preceding, young on elm, July 8

Goodyear, Charles. Tarrytown. C. furfura Fitch, scurfy scale on pear, December 16

Lacy, F. H. Poughkeepsie. Same as preceding, eggs on apple, March 26

Fulton, James. Hayworth, Ill. Through Benjamin Hammond, Fishkill. Same as preceding, eggs on pear, April 20

Goodyear, Charles. Tarrytown. C. euonymi Comst., Euonymus scale, on shrubs and vines, December 16; on Euonymus and Celastrus, January 14

Mac Gregor, J. C. Mount Kisco. Through State Department of Agriculture. Same, adults and young on Euonymus radicans, February 24

Merkel, H. W. New York City. C. pinifoliae Fitch, pine leaf scale, eggs on pine, April 16

Harris, S. G. Tarrytown. Same as preceding, eggs on Pinus cembra, May 2

Cockerell, T. D. A. Los Banos, P. I. Hemichionaspis uvariae Ckll. & Rob., on Uvaria, June 24

Hicks Nurseries. Westbury. Diaspis carueli Targ., Juniper scale, adults on Juniperus virginiana, November 7

Levison, J. J. Brooklyn. Same as preceding, on red cedar, March 16

Merkel, H. W. New York City. Same as preceding, eggs on cedar, April 16

Gordinier, H. W. & Son. Troy. Aulacaspis rosae Sandberg, rose scale on rose, December 19

Cockerell, T. D. A. Los Banos, P. I. Odonaspis schizostachyi Ckll. & Rob., on Schizostachyum, June 24

Goodyear, Charles. Tarrytown. Aspidiotus abietis Schr., hemlock scale on hemlock, January 14

Merkel, H. W. New York City. Same as preceding, eggs on hemlock, April 16

Whaley, F. J. Albany. A. ancylus Putn., Putnam scale, adults on linden, July 8

Moore, Albert. Mount Kisco. A. hederae Vall., white scale, adults on Cattleya, July 2

Goodyear, Charles. Tarrytown. A. perniciosus Comst., San José scale on weeping cherry, December 16

State Department of Agriculture. A. rapax Comst., greedy scale, adult on Baytree, November 11

Kerin, Mrs W. E. Troy. Through H. W. Gordinier. Lepidosaphes ulmi Linn., oyster shell scale, eggs on apple, April 8

Mc Master, Miss M. L. Greenwich. Same as preceding, eggs on lilac, May 11

Cassidy, C. P. Poultney, Vt. Same as preceding, eggs and young, June 26

Soule, Miss M. S. Quaker Street. Chlorochroa uhleri Stal., Juniper plant bug, adults on corn, September 11. Also nymphs and adults, August 23; Euschistus variolarius Pal. Beauv., adults

State Department of Agriculture. Maryland. Arilus cristatus Linn., wheel bug, eggs, December 22

Strickland, L. F. Lockport. Paracalocoris scrupeus Say, nymphs, June 3. Also Neurocolpus nubilis Say, adult on sumac, July 7

Shons, C. R. Washingtonville. Lygidea mendax Reut., false red bug, work on apple, June 12

Gregory, E. S. Niverville. Same as preceding, June 19

de Vyver, J. James. Mount Vernon. Same as preceding, work on apple leaves, June 22

Heilman, J. R. Poughkeepsie. Same as preceding, work, July 2

Duell & Son, C. H. Bangall. Same as preceding, July 6

Lacy, F. H. Poughkeepsie. Same as preceding, July 8. Also from Hyde Park, adults, July 10

Orthoptera

Bradley, Miss May C. Cato. Melanoplus femoratus Burm., two-striped grasshopper, adult, September 29. Also M. femur-rubrum De G., red-legged grasshopper, adult; Encoptolophus sordidus Burm., sordid grasshopper, adult

Thysanura

Cox, D. H. New York City. Lepisma domestica Pack., silver-fish or slide, adult, March 25

Harris, William. Saratoga Springs. Lipura ambulans Linn., in greenhouse soil, February 5

Purchase

Kny-Scheerer Co. New York City

Lepidoptera (butterflies and moths)

Ornithoptera zalmoxis
O. hekuba
Papilio blumei
Teniopalpus imperialis
Papilio rhodifer
P. agenor
Morpho anaxibia
Attacus atlas
Brahmea whitei
Thysania agrippina
Geometrid
Erebus odora
Ophideres aurantia
Ornithoptera rhadamanthus
Morpho sulkowskyi
Stichophthalma camadera
Thaumantis diores
Papilio majo
Eploe vestigiata
Bunnaea caffraria
Hyperchiria janus
Epiphora bauhiniae
Nudaurelia ringleri
Gynanisa maja
Phyllodes sp.
Graellsia isabellae
Ornithoptera lydius
Morpho polyphemus
Ornithoptera urvilleana

Coleoptera (beetles)

Catoxantha opulenta
Mormolyce phyllodes
Odontolabis lowei
Calosoma sycophanta
Chrysina macropus
Chrysaspis speciosa var. fastuosa
Chisognathus granti
Goliathus regius
Euchirus longimanus
Dynastes neptum
Goliathus giganteus
Lithinus nigrocristatus
Batocera ulma
B. armata

Ateuchus sacer
Entimus imperialis
Lamprina aurata
Plusiotus resplendens
Xyllorhiza adusta
Megosoma elephas
Golofa porteri
Euchroma gigantea
Dictyophorus reticulatus

Orthoptera (grasshoppers and walking sticks)

Giant cockroach
Phyllium siccifolium
Phryganistria fruehstorferi
Temera imperialis
Timanthes brunni
Giant grasshoppers
Gryllotalpa sp.

Riker mounts and life histories

Asta, large honey bee
Smaller, red wood ant
Trochilium apiformis
Arctia caja
Coccinella septempunctata
Dissosteira carolina
Periplaneta americana
Murgantia histrionica
Neoclytus erythrocephalus
Pelidnota punctata
Alsophila pometaria
Agrotis ypsilon
Melittia satyriniformis
Noctua c-nigrum
Bombus terricola
Cimbex americana

Exchange

Kuwana, Prof. S. I. Tokio, Japan

Aspidiotus bambusarum *Ckll.*
A. cryptomeriae *Kuw.*
A. paeoniae *Ckll.*
A. secreba *Ckll.*
Chionaspis bambusae *Ckll.*
C. citri *Comst.*
C. hikosani *Kuw.*
C. kiushiuensis *Kuw.*
Mytilaspis crawi *Ckll.*
M. uniloba *Kuw.*
Parlatoria ziziphus *Lucas*
Ischnaspis longirostria *Sign.*
Leucaspis japonica *Ckll.*
Pulvinaria citricola *Kuw.*
P. hazae *Kuw.*
P. horii *Kuw.*
P. idesiae *Kuw.*
P. oyamae *Kuw.*
P. photiniae *Kuw.*
Lecanium glandi *Kuw.*
L. kunoensis *Kuw.*
L. nishigaharae *Kuw.*
Aclerda tokionis *Ckll.*
Lecaniodiaspis quercus *Ckll.*
Ericerus pela *West.*
Eriococcus lagerstroemiae *Kuw.*
Antonia crawi *Ckll.*
Kermes vastus *Kuw.*
Takahashia japonica *Ckll.*
Icerya okodae *Kuw.* equals
I. seychellarum *West.*

Hardy, G. H. Tasmania

Prynus scutellaris *Fabr.*
Paropsis lineata *Marsh.*
P. serpiginosa *Er.*
P. nigerrima *Germ.*
Xanthophaea angustula *Chd.*
Trigonothrops longiplaga *Chd.*
Sarothrocrepis callida
Angonocheila curtula *Er.*
Natalis porcata *Fabr.*
Euchoptera apicalis *Saund.*
Lagria grandis *Gyllh.*
Haltica pagana *Bl.*
Adelium abreviatum *L.*

Johnson, C. W. Boston, Mass.

Odontomyia microstoma *Lw.*
Beris annulifera *Bigot.*
Scoliopelta luteipes *Will.*
Geosargus elegans *Lw.*
Hermetia illucens *Linn.*
Oxycera unifasciata *Lw.*
Nemotelus canadensis *Lw.*
N. unicolor *Lw.*
Chrysops sackeni *Hine*
C. delicatulus *O. S.*
C. montanus *O. S.*
C. pudicus *O. S.*
C. fallax *O. S.*
C. obsoletus *O. S.*
Platypalpus flavirostris *Lw.*
P. aequalis *Lw.*
Drapetis spectabilis *Melander*
Chersodromia houghi *Melander*
(Coloboneura)
Coloboneura inusitata *Melander*
Litanomyia elongata *Melander*
Hemerodromia scapularis *Lw.*
Clinocera simplex *Lw.*
Syneches rufus *Lw.*
Empis distans *Lw.*
E. humilis *Lw.*
E. tridentata *Coq.*
E. loripedis *Coq.*
E. obesa *Lw.*
E. spectabilis *Lw.*
Hilara tristis *Lw.*
H. umbrosa *Lw.*
Oreogeton obscura *Lw.*
Rhamphomyia candicans *Lw.*
R. irregularis *Lw.*
R. luteiventris *Lw.*
R. mutabilis *Lw.*
R. glabra *Lw.*
R. umbilicata *Lw.*
R. gracilis *Lw.*
R. pulla *Lw.*
Dolichopus palaestricus *Lw.*
Pelastoneura cognatus *Lw.*
Gymnopternus laevigatus *Lw.*
Argyra calcitrans *Lw.*
Hypocharassus pruinosus *Whlr.*
Hydrophorus aestuum *Lw.*
H. intentus *Aldrich*
H. chrysologus *Walk.*
Dichaetoneura leucoptera *Johns.*
Hypostena dunningii *Coq.*
H. floridensis *Town.*
Leskia analis *Say*
Exorista vulgaris *Fall.*
Sturmia inquinata *Vdw.*
Masicera festinans *Meign.*
Tachina simulans *Meign.*
Gonia senilis *Will.*
Epigrymyia floridensis *Town.*
Panzeria ruficauda *Brauer*
P. radicans *Fall.*
Peleteria aenea *Staeg.*
Melanophora roralis *Linn.*
Tetramerinx unica *Stein.*
Phyllogaster cordyluroides *Stein.*
Spilogaster pagana *Fabr.*
S. urbana *Meign.*
Limnophora diaphana *Weid.*
Fucillia marina *Macq.*
(Fucorum of authors not Fall.)
Rivellia quadrifasciata *Macq.*
Seoptera vibrans *Linn.*
Acidia fausta *O. S.*
Diastata vagans *Lw.*
Scyphella flava *Linn.*
Milichiella arcuata *Lw.*
Pholeomyia indecora *Lw.*
Agromyza posticata *Meign.*
(A. terminalis Coq. is a synonym according to Malloch)
A. parvicornis *Lw.*
A. melampyga *Lw.*
Dryomyza aristalis *Coq.*
Tetanocera setosa *Coq.*
Clusia lateralis *Walk.*
C. czernyi *Johns.*
Bittacomorpha jonesi *Johns.*

ZOOLOGY

Donation

Birds

Blaschke, F., Yonkers

Flicker, Colaptes auratus luteus Bangs.................. 1
Chimney swift, Chaetura pelagica (Linnaeus)........... 1
Ruby-throated humming bird, Archilochus colubris (Linnaeus) 1
Crested flycatcher, Myiarchus crinitus (Linnaeus)........ 1
Blue jay, Cyanocitta cristata (Linnaeus)............... 1
Crow, Corvus brachyrhynchos Brehm................. 1
Starling, Sturnus vulgaris Linnaeus...................... 1
Red-winged blackbird, Agelaius phoeniceus (Linnaeus).. 1
Baltimore oriole, Icterus galbula (Linnaeus)............ 2
Red crossbill, Loxia curvirostra minor (Brehm)....... 2
Goldfinch, Astragalinus tristis (Linnaeus)............. 2
Indigo bunting, Passerina cyanea (Linnaeus)............ 1
Yellow warbler, Dendroica aestiva (Gmelin)............. 3
Robin, Planesticus migratorius (Linnaeus).......... 1

Cummings, W. L., South Bethlehem, Pa.

Cape May warbler, Dendroica tigrina (Gmelin).......... 1

New York State Conservation Commission, Albany

Bobwhite, Colinus virginianus (Linnaeus)............. 1
Ring-necked pheasant, Phasianus torquatus Gmelin...... 1

Sanford, Dr L. C., New Haven, Conn.

Broad-winged hawk, Buteo platypterus (Vieillot)......... 1

Birds' eggs

Little, Miss E. W., Menands

Ostrich, Struthio camelus Linnaeus........................ 1

Parker, A. C., Albany

Brown pelican, Pelecanus occidentalis Linnaeus........ 1

Reptile

Glynn, Governor Martin H., Albany

Snapping turtle, Chelydra serpentina (Linnaeus)........ 1

Fishes

New York State Conservation Commission, Albany

Banded pickerel, Lucius americanus (Gmelin)........... 2
Burbot, Lota maculosa (Le Sueur)........................ 1

Wagoner, C. A., Troy

Gar pike, Psallisostomus osseus (Linnaeus)............ 1
Dogfish, Amia calva Linnaeus.............................. 2

Invertebrates

Portland Society of Natural History, Portland, Maine

Solemya borealis Totten.................................. 7

Bing, Dr W. A., Albany

Fish parasites, *Ascaris clavata* Rudolphi 4

Loaned by State Conservation Commission, Albany

Mounted mammal

Black bear, *Ursus americanus* Pallas 1

Mounted birds

Horned grebe, *Colymbus auritus* Linnaeus 3
Pied-billed grebe, *Podilymbus podiceps* (Linnaeus) 1
Loon, *Gavia immer* (Brünnich) 1
Black-throated loon, *Gavia arctica* (Linnaeus) 1
Red-throated loon, *Gavia stellata* (Pontoppidan) 1
Puffin, *Fratercula arctica* (Linnaeus) 1
Brünnich murre, *Uria lomvia* (Linnaeus) 2
Razor-billed auk, *Alca torda* (Linnaeus) 1
Dovekie, *Alle alle* (Linnaeus) 1
Parasitic jaeger, *Stercorarius parasiticus* (Linnaeus) .. 1
Kittiwake, *Rissa tridactyla* (Linnaeus) 1
Glaucous gull, *Larus hyperboreus* Gunnerus 1
Herring gull, *Larus argentatus* Pontoppidan 3
Ring-billed gull, *Larus delawarensis* Ord 1
Laughing gull, *Larus atricilla* Linnaeus 1
Bonaparte gull, *Larus philadelphia* (Ord) 2
Gull-billed tern, *Gelochelidon nilotica* (Linnaeus) 1
Common tern, *Sterna hirundo* Linnaeus 1
Arctic tern, *Sterna paradisea* Brünnich 1
Black tern, *Hydrochelidon nigra surinamensis* (Gmelin) 2
Black skimmer, *Rynchops nigra* Linnaeus 1
Sooty shearwater, *Puffinus griseus* (Gmelin) 1
Black-capped petrel, *Aestrelata hasitata* (Kuhl) 1
Leach petrel, *Oceanodroma leucorhoa* (Vieillot) 1
Wilson petrel, *Oceanites oceanicus* (Kuhl) 1
Gannet, *Sula bassana* (Linnaeus) 1
Common cormorant, *Phalacrocorax carbo* (Linnaeus) 1
Double-crested cormorant, *Phalacrocorax auritus* (Lesson) 1
Brown pelican, *Pelecanus occidentalis* Linnaeus 1
American merganser, *Mergus americanus* Cassin 2
Red-breasted merganser, *Mergus serrator* Linnaeus 2
Hooded merganser, *Lophodytes cucullatus* (Linnaeus) 2
Mallard, *Anas playtyrhynchos* Linnaeus 2
Black duck, *Anas rubripes* Brewster 2
Baldpate, *Mareca americana* (Gmelin) 2
Green-winged teal, *Nettion carolinense* (Gmelin) 2
Blue-winged teal, *Querquedula discors* (Linnaeus) 2
Shoveler, *Spatula clypeata* (Linnaeus) 1
Pintail, *Dafila acuta* (Linnaeus) 2

Wood duck, Aix sponsa (Linnaeus) 2
Redhead, Marila americana (Eyton) 1
Canvasback, Marila valisineria (Wilson) 2
Greater scaup duck, Marila marila (Linnaeus) 1
Lesser scaup duck, Marila affinis (Eyton) 2
Golden-eye, Clangula clangula americana Bonaparte.. 1
Buffle-head, Charitonetta albeola (Linnaeus) 1
Old squaw, Harelda hyemalis (Linnaeus) 3
Harlequin duck, Histrionicus histrionicus (Linnaeus). 1
American eider, Somateria dresseri Sharpe 1
King eider, Somateria spectabilis (Linnaeus) 1
American scoter, Oidemia americana Swainson 1
White-winged scoter, Oidemia deglandi Bonaparte 1
Surf scoter, Oidemia perspicillata (Linnaeus) 1
Ruddy duck, Erismatura jamaicensis (Gmelin) 2
Greater snow goose, Chen hyperboreus nivalis (Forster). 2
White-fronted goose, Anser albifrons gambeli Hartlaub. 1
Canada goose, Branta canadensis (Linnaeus) 1
Whistling swan, Olor columbianus (Ord) 1
Bittern, Botaurus lentiginosus (Montague) 1
Least bittern, Ixobrychus exilis (Gmelin) 1
Egret, Herodias egretta (Gmelin) 1
Little blue heron, Florida caerulea (Linnaeus) 1
Green heron, Butorides virescens (Linnaeus) 1
Black-crowned night heron, Nycticorax nycticorax naevius (Boddaert) 1
Yellow-crowned night heron, Nyctanassa violacea (Linnaeus) 1
King rail, Rallus elegans Audobon 1
Clapper rail, Rallus crepitans Gmelin 1
Sora, Porzana carolina (Linnaeus) 1
Yellow rail, Coturnicops noveboracensis (Gmelin) ... 1
Purple gallinule, Ionornis martinicus (Linnaeus) 1
Florida gallinule, Gallinula galeata (Lichtenstein) 2
Coot, Fulica americana Gmelin 1
Northern phalarope, Lobipes lobatus (Linnaeus) 1
Wilson phalarope, Steganopus tricolor Vieillot 1
Avocet, Recurvirostra americana Gmelin 1
Woodcock, Philohela minor (Gmelin) 2
Wilson snipe, Gallinago delicata (Ord) 1
Dowitcher, Macrorhamphus griseus (Gmelin) 1
Long-billed dowitcher, Macrorhamphus griseus scolopaceus (Say) 1
Knot, Tringa canutus (Linnaeus) 1
Purple sandpiper, Arquatella maritima (Brünnich) 2
Pectoral sandpiper, Pisobia maculata (Vieillot) 1
White-rumped sandpiper, Pisobia fuscicollis (Vieillot) ... 1
Baird sandpiper, Pisobia bairdi (Coues) 1
Least sandpiper, Pisobia minutilla (Vieillot) 1
Red-backed sandpiper, Pelidna alpina sakhalina (Vieillot) 1

Sanderling, Calidris leucophaea (Pallas)................ 1
Marbled godwit, Limosa fedoa (Linnaeus)................. 1
Greater yellow-legs, Totanus melanoleucus (Gmelin)... 2
Solitary sandpiper, Totanus flavipes (Gmelin)........... 1
Willet, Catoptrophorus semipalmatus (Gmelin)...... 2
Upland plover, Bartramia longicauda (Bechstein)....... 1
Spotted sandpiper, Actitis macularia (Linnaeus).......... 1
Long-billed curlew, Numenius americanus Bechstein.... 1
Hudsonian curlew, Numenius hudsonicus Latham........ 1
Black-bellied plover, Squatarola squatarola (Linnaeus).. 1
Golden plover, Charadrius dominicus Müller........... 1
Killdear plover, Oxyechus vociferus (Linnaeus)......... 1
Semipalmated plover, Aegialitis semipalmata (Bonaparte). 1
Piping plover, Aegialitis meloda (Ord).................. 1
Wilson plover, Ochthodromus wilsonius............... 1
Turnstone, Arenaria interpres morinella (Linnaeus). 1
Oyster-catcher, Haematopus palliatus Temminck........ 1
Bob-white, Colinus virginianus (Linnaeus)............. 2
Canada grouse, Canachites canadensis canace (Linnaeus) 2
Ruffed grouse, Bonasa umbellus (Linnaeus)............... 3
Ring-necked pheasant, Phasianus torquatus Gmelin....... 4
Hungarian partridge, Perdix cinerea Linnaeus............ 4
Mourning dove, Zenaidura macroura carolinensis (Linnaeus) 1
Sharp-shinned hawk, Accipiter velox (Wilson)........... 1
Cooper hawk, Accipiter cooperi (Bonaparte)............. 2
Red-tailed hawk, Buteo borealis (Gmelin).................. 1
Rough-legged hawk, Archibuteo lagopus sancti-johannis (Gmelin)... 1
Bald eagle, Haliaeetus leucocephalus (Linnaeus)...... 1
Duck hawk, Falco peregrinus anatum Bonaparte......... 1
Pigeon hawk, Falco columbarius Linnaeus............... 1
Sparrow hawk, Falco sparverius Linnaeus................ 2
Osprey, Pandion haliaëtus carolinensis (Gmelin).. 1
Long-eared owl, Asio wilsonianus (Lesson).............. 1
Great gray owl, Scotiaptex nebulosa (Foster).......... 1
Richardson owl, Cryptoglaux funerea richardsoni (Bonaparte) 1
Saw-whet owl, Cryptoglaux acadica (Gmelin)............ 2
Screech owl, Otus asio (Linnaeus)......................... 1
Snowy owl, Nyctea nyctea (Linnaeus)..................... 1
Yellow-billed cuckoo, Coccyzus americanus (Linnaeus).. 1
Black-billed cuckoo, Coccyzus erythrophthalmus (Wilson) 1
Belted kingfisher, Ceryle alcyon (Linnaeus).............. 1
Hairy woodpecker, Dryobates villosus (Linnaeus)......... 1
Downy woodpecker, Dryobates pubescens (Linnaeus).... 1
Arctic three-toed woodpecker, Picoides arcticus (Swainson). 2
Yellow-bellied sapsucker, Sphyrapicus varius (Linnaeus).. 1

Pileated woodpecker, Phloeotomus principalis abieticola (Bangs)	1
Red-headed woodpecker, Melanerpes erythrocephalus (Linnaeus)	1
Red-bellied woodpecker, Centurus carolinus (Linnaeus)	1
Flicker, Colaptes auratus luteus Bangs	1
Whip-poor-will, Antrostomus vociferus (Wilson)	1
Night hawk, Chordeiles virginianus (Gmelin)	1
Chimney swift, Chaetura pelagica (Linnaeus)	1
Ruby-throated hummingbird, Archilochus colubris (Linnaeus)	1
Kingbird, Tyrannus tyrannus (Linnaeus)	1
Phoebe, Sayornis phoebe (Latham)	2
Olive-sided flycatcher, Nuttallornis borealis (Swainson)	1
Yellow-bellied flycatcher, Empidonax flaviventris (Baird)	1
Green-crested flycatcher, Empidonax virescens (Vieillot)	1
Alder flycatcher, Empidonax trailli alnorum (Brewster)	1
Least flycatcher, Empidonax minimus (Baird)	2
Horned lark, Otocoris alpestris (Linnaeus)	1
Prairie horned lark, Otocoris alpestris praticola Henshaw	2
Blue jay, Cyanocitta cristata (Linnaeus)	2
Canada jay, Perisoreus canadensis (Linnaeus)	1
Raven, Corvus corax principalis Ridgway	1
Crow, Corvus brachyrhynchos Brehm	1
Starling, Sturnus vulgaris Linnaeus	2
Bobolink, Dolichonyx oryzivorus (Linnaeus)	1
Cowbird, Molothrus ater (Boddaert)	1
Red-winged blackbird, Agelaius phoeniceus (Linnaeus)	1
Meadowlark, Sturnella magna (Linnaeus)	1
Baltimore oriole, Icterus galbula (Linnaeus)	1
Rusty blackbird, Euphagus carolinus (Müller)	1
Purple grackle, Quiscalus quiscula quiscula (Linnaeus)	1
Bronzed grackle, Quiscalus quiscula aeneus Ridgway	1
Pine grosbeak, Pinicola enucleator leucura (Müller)	2
English sparrow, Passer domesticus (Linnaeus)	1
Purple finch, Carpodacus purpureus (Gmelin)	1
American crossbill, Loxia curvirostra minor (Brehm)	2
White-winged crossbill, Loxia leucoptera Gmelin	1
Redpoll, Acanthis linaria (Linnaeus)	1
American goldfinch, Astragalinus tristis (Linnaeus)	1
Pine siskin, Spinus pinus (Wilson)	2
European goldfinch, Carduelis elegans (Linnaeus)	1
Snow bunting, Plectrophenax nivalis (Linnaeus)	2
Lapland longspur, Calcarius lapponicus (Linnaeus)	1
Vesper sparrow, Pooecetes gramineus (Gmelin)	1
Savannah sparrow, Passerculus sandwichensis savanna (Wilson)	1
Grasshopper sparrow, Ammodramus savannarum australis Maynard	1
Henslow sparrow, Passerherbulus henslowi (Audubon)	1

Sharp-tailed sparrow, Passerherbulus caudacutus (Gmelin) 1
White-throated sparrow, Zonotrichia albicollis (Gmelin).
Tree sparrow, Spizella monticola (Gmelin) 1
Chipping sparrow, Spizella passerina (Bechstein) 1
Field sparrow, Spizella pusilla (Wilson) 2
Lincoln sparrow, Melospiza lincolni (Audubon) 1
Fox sparrow, Passerella iliaca (Merrem) 2
Towhee, Pipilo erythrophthalmus (Linnaeus) 1
Cardinal, Cardinalis cardinalis (Linnaeus) 1
Rose-breasted grosbeak, Zamelodia ludoviciana (Linnaeus) 1
Purple martin, Progne subis (Linnaeus) 1
Cliff swallow, Petrochelidon lunifrons (Say) 1
Bohemian waxwing, Bombycilla garrula (Linnaeus) 1
Cedar waxwing, Bombycilla cedrorum Vieillot 2
Northern shrike, Lanius borealis Vieillot 1
Migrant shrike, Lanius ludovicianus migrans Palmer. 1
Red-eyed vireo, Vireosylva olivacea (Linnaeus) 1
Philadelphia vireo, Vireosylva philadelphica Cassin... 1
Black and white warbler, Mniotilta varia (Linnaeus) 1
Prothonotary warbler, Protonotaria citrea (Boddaert).... 1
Worm-eating warbler, Helmitheros vermivorus (Gmelin) 1
Blue-winged warbler, Vermivora pinus (Linnaeus) 1
Golden-winged warbler, Vermivora chrysoptera (Linnaeus) 1
Parula warbler, Compsothlypis americana usneae Brewster 1
Yellow warbler, Dendroica aestiva (Gmelin) 1
Black-throated blue warbler, Dendroica caerulescens (Gmelin) 1
Myrtle warbler, Dendroica coronata (Linnaeus) 1
Chestnut-sided warbler, Dendroica pensylvanica (Linnaeus) 1
Bay-breasted warbler, Dendroica castanea (Wilson) 1
Black-pool warbler, Dendroica striata (Forster) 1
Blackburnian warbler, Dendroica fusca (Müller) 1
Black-throated green warbler, Dendroica virens (Gmelin).. 1
Palm warbler, Dendroica vigorsi (Audubon) 1
Yellow palm warbler, Dendroica palmarum hypochrysea Ridgway 1
Oven bird, Seiurus aurocapillus (Linnaeus) 1
Water thrush, Seiurus noveboracensis (Gmelin) 1
Louisiana water thrush, Seiurus motacilla (Vieillot) 1
Kentucky warbler, Oporornis formosus (Wilson) 1
Connecticut warbler, Oporornis agilis (Wilson) 1
Mourning warbler, Oporornis philadelphia (Wilson).... 1
Maryland yellow-throat, Geothlypis trichas (Linnaeus).. 1
Yellow-breasted chat, Icteria virens (Linnaeus) 1

Hooded warbler, Wilsonia citrina (Boddaert)	2
Wilson warbler, Wilsonia pusilla (Wilson)	1
Canadian warbler, Wilsonia canadensis (Linnaeus)	1
Redstart, Setophaga ruticilla (Linnaeus)	1
American pipit, Anthus rubescens (Tunstall)	1
Mockingbird, Mimus polyglottos (Linnaeus)	1
Catbird, Dumetella carolinensis (Linnaeus)	1
Brown thrasher, Toxostoma rufum (Linnaeus)	1
Carolina wren, Thryothorus ludovicianus (Latham)	1
Winter wren, Nannus hiemalis (Vieillot)	1
White-breasted nuthatch, Sitta carolinensis Latham	2
Red-breasted nuthatch, Sitta canadensis Linnaeus	1
Brown-headed nuthatch, Sitta pusilla Latham	1
Chickadee, Penthestes atricapillus (Linnaeus)	1
Hudsonian chickadee, Penthestes hudsonicus (Forster)	1
Golden-crowned kinglet, Regulus satrapa Lichtenstein	1
Wood thrush, Hylocichla mustelina (Gmelin)	1
Olive-backed thrush, Hylocichla ustulata swainsoni (Tschudi)	1
Hermit thrush, Hylocichla guttata pallasi (Cabanis)	1
Robin, Planesticus migratorius (Linnaeus)	1
Bluebird, Sialia sialis (Linnaeus)	1

Mounted fishes

Sea lamprey, Petromyzon marinus Linnaeus	1
Common sturgeon, Acipenser sturio Linnaeus	1
Short-nosed sturgeon, Acipenser brevirostrum Le Sueur	1
Gar pike, Psallisostomus osseus (Linnaeus)	1
Bowfin, Amia calva Linnaeus	1
Bullhead, Ameiurus nebulosus (Le Sueur)	1
Long-nosed sucker, Catostomus catostomus (Forster)	1
Common sucker, Catostomus commersonii (Lacepede)	2
Hog sucker, Catostomus nigricans Le Sueur	1
Red horse sucker, Moxostoma aureolum (Le Sueur)	1
Fallfish, Semotilus bullaris (Rafinesque)	1
Carp, Cyprinus carpio Linnaeus	1
Common eel, Anguilla chrispa Rafinesque	2
Conger eel, Leptocephalus conger (Linnaeus)	1
Herring, Clupea harengus Linnaeus	1
Hickory shad, Pomolobus mediocris (Mitchill)	1
Alewife, Pomolobus pseudoharengus (Wilson)	1
Shad, Alosa sapidissima (Wilson)	1
Menhaden, Brevoortia tyrannus (Latrobe)	1
Round whitefish, Coregonus quadrilateralis Richardson	1
Common whitefish, Coregonus clupeiformis (Mitchill)	1
Atlantic salmon, Salmo salar Linnaeus	1
Red-throat trout, Salmo henshawi Gill & Jordan	1
Brown trout, Salmo fario Linnaeus	2
Rainbow trout, Salmo irideus Gibbons	2
Hybrid trout, Salmo fario + Salvelinus fontinalis	1
Lake trout, Cristivomer namaycush (Walbaum)	3

Brook trout, Salvelinus fontinalis (Mitchill)	5
Grayling, Thymallus montanus (Milner)	1
Smelt, Osmerus mordax (Mitchill)	1
Banded pickerel, Lucius americanus (Gmelin)	1
Common pickerel, Lucius reticulatus (Le Sueur)	2
Pike, Lucius lucius (Linnaeus)	2
Muskellunge, Lucius masquinongy (Mitchill)	1
Chautauqua muskellunge, Lucius ohiensis Kirtland	1
Mullet, Mugil cephalus Linnaeus	1
Mackerel, Scomber scombrus Linnaeus	1
Bonito, Sarda sarda (Bloch)	1
Spanish mackerel, Scomberomorus maculatus (Mitchill)	1
Cutlass fish, Trichiurus lepturus Linnaeus	1
Pompano, Trachinotus carolinus (Linnaeus)	1
Bluefish, Pomatomus saltatrix (Linnaeus)	1
Butterfish, Poronotus triacanthus (Peck)	1
Crappie, Pomoxis annularis Rafinesque	1
Calico bass, Pomoxis sparoides (Lacépède)	1
Rock bass, Ambloplites rupestris (Rafinesque)	1
Common sunfish, Eupomotis gibbosus (Linnaeus)	1
Small-mouthed black bass, Micropterus dolomieu Lacépède	1
Large-mouthed black bass, Micropterus salmoides Lacépède	2
Wall-eyed pike, Stizostedion vitreum (Mitchill)	3
Gray sand pike, Stizostedion canadense griseum (DeKay)	1
Yellow perch, Perca flavescens (Mitchill)	2
White bass, Roccus chrysops (Rafinesque)	1
Striped bass, Roccus lineatus (Bloch)	1
White perch, Morone americana (Gmelin)	1
Sea bass, Centropristes striatus Linnaeus	1
Red snapper, Lutianus blackfordii Goode & Bean	1
Porgy, Stenotomus chrysops (Linnaeus)	1
Sheepshead, Archosargus probatocephalus (Walbaum)	1
Weakfish, Cynoscion regalis (Bloch & Schneider)	1
Sea trout, Cynoscion nebulosus (Cuvier & Valenciennes)	1
Red drumfish, Sciaenops ocellatus (Linnaeus)	2
Croaker, Micropogon undulatus (Linnaeus)	1
Kingfish, Menticirrhus saxatilis (Bloch & Schneider)	1
Cunner, Tautogolabrus adspersus (Walbaum)	1
Blackfish, Tautoga onitis (Linnaeus)	1
Spadefish, Chaetodipterus faber (Broussonet)	1
Rosefish, Sebastes marinus Linnaeus	1
Scalpin, Myoxocephalus octodecimspinosus (Mitchill)	1
Sea raven, Hemitripterus americanus (Gmelin)	1
Lump sucker, Cyclopterus lumpus Linnaeus	1
Wolf fish, Anarhichas lupus Linnaeus	1
Eel pout, Zoarces anguillaris (Peck)	1
Shark sucker, Echeneis naucrates Linnaeus	1

Whiting, Merlucius bilinearis (Mitchill)................ 1
Pollack, Pollachius virens (Linnaeus)................... 1
Frost fish, Microgadus tomcod (Walbaum)................. 1
Codfish, Gadus callarias Linnaeus....................... 1
Haddock, Melanogrammus aeglefinus (Linnaeus)............ 1
Burbot, Lota maculosa (Le Sueur)........................ 1
Spotted hake, Phycis regius (Walbaum)................... 1
Squirrel hake, Phycis chuss (Walbaum)................... 1
Cusk, Brosme brosme (Müller)............................ 1
Halibut, Hippoglossus hippoglossus (Linnaeus)........... 1
Rough dab, Hippoglossoides platessoides (Fabricus). 1
Summer flounder, Paralichthys dentatus (Linnaeus)....... 1
Winter flounder, Pseudopleuronectes americanus (Walbaum).. 1

Purchase

Mammals

Elliott, J. C. East Greenbush

Gray fox, Urocyon cinereoargentatus (Schreber).... 1

Hartley, B. M. West Haven, Conn.

Woodchuck, Marmota monax (Linnaeus)................. 2

Birds (mounted)

Barker, Fred. Parker's Prairie, Minn.

Pied-billed grebe, Podilymbus podiceps (Linnaeus)...... 3
Loon, Gavia immer (Brünnich)............................ 1
Herring gull, Larus argentatus Pontoppidan.............. 1
Ring-billed gull, Larus delawarensis Ord................ 1
Bonaparte gull, Larus philadelphia (Ord)................ 1
Mallard, Anas platyrhynchos Linnaeus.................... 1
Cinnamon teal, Querquedula cyanoptera (Vieillot).... 2
Redhead, Marila americana (Eyton)....................... 2
Greater scaup duck, Marila marila (Linnaeus)............ 1
Lesser scaup duck, Marila affinis (Eyton)............... 1
White-winged scoter, Oidemia deglandi Bonaparte......... 3
Surf scoter, Oidemia perspicillata (Linnaeus)........... 3
Black rail, Creciscus jamaicensis (Gmelin).............. 1
Coot, Fulica americana Gmelin........................... 1
Black-necked stilt, Himantopus mexicanus (Müller).... 2
Woodcock, Philohela minor (Gmelin)...................... 1
Knot, Tringa canutus Linnaeus........................... 1
Sanderling, Calidris leucophaea (Pallas)................ 1
Marbled godwit, Limosa fedoa (Linnaeus)................. 2
Hudsonian godwit, Limosa haemastica (Linnaeus).......... 1
Greater yellowlegs, Totanus melanoleucus (Gmelin).... 1
Hudsonia curlew, Numenius hudsonicus Latham............. 1
Bobwhite, Colinus virginianus (Linnaeus)................ 2
Marsh hawk, Circus hudsonius (Linnaeus)................. 3

Cooper hawk, Accipiter cooperi (Bonaparte)............. 1
Goshawk, Astur atricapillus (Wilson).................. 1
Red-tailed hawk, Buteo borealis (Gmelin)................ 1
Swainson hawk, Buteo swainsoni Bonaparte.............. 1
Great gray owl, Scotiaptex nebulosa (Forster).......... 1
Hawk owl, Surnia ulula caparoch (Müller)............ 1
Burrowing owl, Speotyto cunicularia hypogaea (Bonaparte) 2
Black-billed cuckoo, Coccyzus erythrophthalmus (Wilson) 2
Kingfisher, Ceryle alcyon (Linnaeus)..................... 2
Hairy woodpecker, Dryobates villosus (Linnaeus)........ 1
Red-headed woodpecker, Melanerpes erythrocephalus (Linnaeus) 1
Red-bellied woodpecker, Centurus carolinus (Linnaeus)... 2
Night hawk, Chordeiles virginianus (Gmelin).......... 1
Chimney swift, Chaetura pelagica (Linnaeus)............. 1
Kingbird, Tyrannus tyrannus (Linnaeus)................ 2
Arkansas kingbird, Tyrannus verticalis Say............. 1
Horned lark, Otocoris alpestris (Linnaeus)............. 2
Magpipe, Pica pica hudsonia (Sabine).................. 1
Bobolink, Dolichonyx oryzivorus (Linnaeus)............ 1
Yellow-headed blackbird, Xanthocephalus xanthocephalus (Bonaparte).. 2
Red-winged blackbird, Agelaius phoeniceus (Linnaeus)... 1
Baltimore oriole, Icterus galbula (Linnaeus)............... 2
Bullock oriole, Icterus bullocki (Swainson)............... 1
Rusty blackbird, Euphagus carolinus (Müller)........... 2
Bronzed grackle, Quiscalus quiscula aeneus Ridgway.. 3
Evening grosbeak, Hesperiphona vespertina (Cooper). 1
Pine grosbeak, Pinicola enucleator leucura (Müller). 1
Purple finch, Carpodacus purpureus (Gmelin)........... 2
American crossbill, Loxia curvirostra minor (Brehm).. 3
White-winged crossbill, Loxia leucoptera Gmelin........... 1
Hoary redpoll, Acanthis hornemanni exilipes (Coues). 4
Redpoll, Acanthis linaria (Linnaeus)..................... 3
Goldfinch, Astragalinus tristis (Linnaeus).............. 1
Snow bunting, Plectrophenax nivalis (Linnaeus)........ 2
Lapland longspur, Calcarius lapponicus (Linnaeus)...... 2
Savannah sparrow, Passerculus sandwichensis savanna (Wilson).. 1
Leconte sparrow, Passerherbulus lecontei Audubon.... 2
Lark sparrow, Chondestes grammacus (Say).......... 1
White-throated sparrow, Zonotrichia albicollis (Gmelin). 2
Swamp sparrow, Melospiza georgiana (Latham).......... 2
Cardinal grosbeak, Cardinalis cardinalis (Linnaeus).... 1
Blue grosbeak, Guiraca caerulea (Linnaeus)............... 1
Indigo bunting, Passerina cyanea (Linnaeus).............. 1
Lark bunting, Calamospiza melanocorys Stejneger.... 1
Louisiana tanager, Piranga ludoviciana (Wilson)........ 1
Barn swallow, Hirundo erythrogastra Boddaert......... 2

Bohemian waxwing, Bombycilla garrula (Linnaeus)...... 1
Cedar waxwing, Bombycilla cedrorum Vieillot.......... 1
Warbling vireo, Vireosylva gilva (Vieillot)................ 1
Black and white warbler, Mniotilta varia (Linnaeus)........ 1
Tennessee warbler, Vermivora peregrina (Wilson)..... 1
Cape May warbler, Dendroica tigrina (Gmelin)............ 1
Yellow warbler, Dendroica aestiva (Gmelin).............. 1
Magnolia warbler, Dendroica magnolia (Wilson)......... 2
Bay-breasted warbler, Dendroica castanea (Wilson)...... 1
Blackburnian warbler, Dendroica fusca (Müller).......... 2
Water thrush, Seiurus noveboracensis (Gmelin)........ 2
Wilson warbler, Wilsoni pusilla (Wilson)................ 1
Redstart, Setophaga ruticilla (Linnaeus)................ 2
Catbird, Dumetella carolinensis (Linnaeus)............ 1
House wren, Troglodytes aedon (Vieillot)................ 2
Short-billed marsh wren, Cistothorus stellaris (Naumann) 2
Long-billed marsh wren, Telmatodytes palustris (Wilson) 1
Golden-crowned kinglet, Regulus satrapa Lichtenstein..... 1
Ruby-crowned kinglet, Regulus calendula (Linnaeus)...... 1
Olive-backed thrush, Hylocichla ustulata swainsoni (Tschudi) 3
Robin, Planesticus migratorius (Linnaeus)............ 2
Varied thrush, Ixoreus naevius (Gmelin).................. 1
Bluebird, Sialia sialis (Linnaeus)......................... 1

Marsters, C. E. Albany

Ruffed grouse, Bonasa umbellus (Linnaeus).............. 1

Amphibians (casts)

Franklin, Dwight. New York City

Spotted salamander, Ambystoma punctatum (Linnaeus).. 1
Tiger salamander, Ambystoma tigrinum Green........... 1
Red salamander, Spelerpes ruber (Daudin)................ 1
Spade-foot toad, Scaphiopus holbrooki (Harlan)........ 1
Spring peeper, Hyla pickeringii Storer.................. 1
Leopard frog, Rana pipiens Schreber..................... 1
Pickerel frog, Rana palustris Le Conte.................. 1
Green frog, Rana clamata Dandin......................... 1
Bull frog, Rana catesbeiana Shaw........................ 1
Wood frog, Rana sylvatica Le Conte...................... 1

CONCEPTIONS REGARDING THE AMERICAN DEVONIC[1]

BY JOHN M. CLARKE

This theme has seemed to me appropriate to the present occasion because, primarily, of Professor Kayser's positive influence upon the accepted interpretation of the Devonic system in the Western Hemisphere and, in a broader sense, for his long and intimate concern with the various aspects of this great period in the history of the earth.

It is thirty-six years since the publication of Kayser's important treatise on the Lowest Devonic Formations of the Hartz Mountains, and this, more than any other single work, inaugurated a reconstruction of ideas concerning the scope of the Devonic system; in so doing, it created new problems and inspired investigations into a wider field. Thirty-six years ago the writer of this paper, truly a native of the Devonic, was fresh from college and full of enthusiasm over the study of this formation. Throughout the stretch of years since then, both have labored continuously over the Devonic problems, for much of the time in close and sympathetic touch, the younger man receiving from the elder, in information, suggestion and inspiration, debts which can be repaid only in service to a common science.

The State of New York, which has been the writer's port of departure into this field, is very properly designated a Devonic state, for more than one-half its area is covered by the rocks of the period, and the succession of its members from base to summit comprises a record whose pages are almost intact and effectively illustrate the variant happenings of the time. In America we were long in the way of endeavoring to square all the Paleozoic formations of the country with the New York standard column. The work of the founders of the "New York Series of Formations" in establishing their classification, nearly seventy-five years ago, was well done, but the amplification of our knowledge has now clearly shown that in all elements of the Paleozoic except the Devonic (the Cambric, Lower and Upper Siluric and Carbonic), the New

[1] The distinguished career in geological science of Professor Emanuel Kayser of Marburg was to have been specially celebrated on his seventieth birthday, 1915, by the publication of a *Festschrift* of essays by his colleagues and students. For this purpose and occasion the essay here given was prepared.

York record is imperfect, both in sedimentation and in life; not from extensive erosive destruction, but from minor diastrophies and unfavorable geography. But the same growth of knowledge has fortified the standard New York Devonic section as thoroughly complete and indicial, lacking in no essential detail in quality of development, presenting in some degree at least all the phases of the system as exhibited in its transcontinental development, however these phases may vary in magnitude from great to small.

It is within reason and accuracy, then, to say that not in Devonshire nor in the Rhineland, not in the Urals nor in Siberia, not on the Bosporus or in South Africa, not in the basin of the Amazon, of the La Plata or in the Andean Cordilleras, is the full and variant succession of Devonic events so well recorded or at least so clearly and simply presented, and perhaps so fully known, as in New York. Upon this stage the successive scenes of the great drama were set without serious intermission and the players made their exits and their entrances till the curtain fell.

The panorama of development in Devonic geography and life here set forth has justified the arduous years of labor spent upon its elucidation. The efforts made to turn upon the New York record every ray of light that any other part of the earth could contribute have served to establish its integrity and to fortify it as the ideal monument of Devonic history; while, in its turn, it has responded like a Rosetta Stone, in helping to decipher the significance of the fragmentary and less known. Its problems are as many as the growing host of students which later years have drawn to their solution, but there are some of general import bearing broadly upon the interpretation of the system as a whole to which it is here designed to make special allusion.

I THE LOWER BOUNDARY

The limestone faunas. The problem of the base of the system never became a matter of serious question until brought into the foreground by Professor Kayser's proposition that the limestone faunas of the northern Hartz and the F, G, H stages of Bohemia, which had passed as Upper Siluric, were logically and more appropriately to be regarded as a deeper water facies of the early Devonic seas. In presenting the broader correlations which resulted from his discussion of the general theme, Kayser included with the equivalents of these misinterpreted lower Devonic lime faunas, the "Lower Helderberg" formation of New York and its various subdivisions. Just here was the entering wedge for the American problem. Soon Tschernyschew in the Urals, Barrois in the Asturias

and northern France, added confirmatory evidence for the new interpretation, but still Kayser's correlation for the "Lower Helderberg" of New York remained obviously based on literature only. In those days an intimation of this kind coming from Germany to America, for the time being was lost. Under the best of conditions it takes years for the suggestion of a foreign literature to percolate into the counsels of the coworker in a different language. In 1878 and those years, few American geologists of influence knew anything about the German language or of German geology, and Kayser's suggestions, so far as New York was concerned, fell on dull ears. Ten years passed before the evidence of the Devonic age of the Helderberg formation was summarized in detail and set forth in a New York publication, and even then it was presented in tentative form. The writer was responsible for this presentation. His chief in the geological service of New York, the distinguished James Hall, was so absolutely hostile to the suggested interpretation that, in order to even secure publication for this array of evidence, it became necessary to change a positive argument into a neutral statement of facts and all conclusions into queries. But for New York and America the "Hercyn-frage" became the "Helderberg question," thenceforth quietly but effectively argued with intensive massing of the facts, in which a strong part was taken by Schuchert, until in 1908, twenty years after the effective proposition was made, the Helderberg formation with the profuse lime-faunas of all its subdivisions save that at the base, was formally incorporated into the Devonic, in a revision of the New York classification by Mr Schuchert and the writer; and there it seems likely to remain.

The embarrassments which involved the acceptance of this apparently simple proposition were, in actual structure and fact, more weighty in effect than was the widespread and outspoken antagonism in Europe to Kayser's proposition. Here there were few parties of interest and here the succession from the Siluric upward was unbroken, either by erosion or disconformity.

In both countries the abstraction of the Helderberg equivalents meant a paring down of the Murchisonian conception of the Siluric, which, through Murchison's personal intervention, had been deeply engrafted on Hall's construction of the Siluric here. This procedure was of serious import, and a consequence has been, for New York anyway, a reduction of the Siluric (Upper Siluric) to its lowest terms, that is to say, practically a reduction to its Wenlock equivalent (Niagaran), supplemented below by heavy local sands, and above by local developments due to the peculiar geography which

made and unmade the Salina sea. The particular aspect of the problem regarding the base of the Devonic that we are now considering has a somewhat localized significance in America, for the lime sediments of this time, with their rich faunas, are quite essentially (though not exclusively) of Appalachian origin. Throughout the great stretch of the Appalachians from southwest to northeast, the Helderberg seems only very gradually to become disentangled from its Siluric affiliations. In the State of Maryland a great mass of lime-clay sedimentation (Keyser member) lies at the base of the Helderberg members as developed in New York. There it embraces the maximum sedimentation of the lime seas stage and its fossils have but partly disentangled themselves from Siluric connections. In New York the place of this formation is held by lime units which fail to carry the Helderberg fauna and are therefore excluded from that formation. In Gaspé bay, on the other hand, in the far northeast Appalachians of lower Quebec (and probably in the extensively altered regions between New York and there), the discordance between the Helderberg and the Siluric is absolute, profound and fundamental. There the Siluric failed entirely or has been ground out by overthrust. Farther south in Gaspé, conformity is resumed in strata standing at extreme angles, but here, at Percé and in the head of the Bay Chaleur at Dalhousie, the aspect of the correlative lime sediments changes, and in places a large element of Atlantic species is introduced into the fauna and we are no longer dealing with like quantities.

The sandstone transgression. It is well understood that the shallow water transgression of the early Devonic was vast in its amplitude. At no level in the Paleozoic column is the overriding of the former shore lines by the shallow marine waters so emphatically marked. This extraordinary transgression resulting from a slight but almost universal negative diastrophy, spread over the earth a fauna of large proportions and homogeneous character, in great part a derivative from the deeper lime sediments of the contemporaneous sea, but always an adjunct of the spreading shallow waters. As the transgression proceeded, it carried with it species out of their normal development basins into others where they never became climacteric or elemental, but stand today as a key to the fact and the direction of their migration. It has been thought that with the close of the Siluric the great Arctic bay which reached down into the interior of the continent had become largely obliterated, but this contraction seems to have been essentially at the south and the northward and westward transgression over the north Atlantic

lands of Laurentia from the bays of southern England, Belgium and the Rhine brought into the embayments of the eastern Appalachian rias, in Maine, in Nova Scotia and New Brunswick, percentages of Coblentzian species quite foreign to the sandstone or Oriskany fauna as it was normally developed in our interior sea. The presence of these Coblentzian species in Atlantic lands is itself another confirmatory evidence of the upstanding and overridden land bridge across the north Atlantic continuing onward from early Cambric time into the final and continental phases of Devonic sedimentation.

In Appalachia, the spread of the sands was not alone shoreward over the low-lying rocks of the Siluric, but the disastrophy must have been the slight movement of a low, inclined plane whose negative motion in the old land was counterbalanced by a positive movement in the region of deeper water, for the earliest Oriskany sands are notably calcareous in the fields which had been occupied by the Helderberg sea, but as notably lime-free over regions of the shoreward transgression. These facts are evident in the Helderberg regions of Maryland, Pennsylvania and eastern New York, close upon the Appalachian heart, and confirmed by the sands of the extra-Appalachian regions of western-central New York, Ontario and Illinois.

We may have been disposed to believe that the typical fauna of these early sands in America, which in this place we may characterize as Oriskany, an assemblage made distinctive by its heavy shelled brachiopods, *Rensselaeria* (*ovoides* group), *Hipparionyx, Leptaenaventricosa, Spirifer* (*arenosus* type) and species of the *Spirifer murchisoni* group, large *Leptostrophias, Plethorhynchus, Leptocoelia flabellites,* etc., gastropods of large size (*Diaphorostoma ventricosa* and many capulids); these and their less conspicuous associates were normal to these shallow waters; but there is good evidence that the fauna of the sands and their shallow waters were actually adjusted by slow adaption from the deeper waters of the lime bottoms. This proposition would always be reasonable under general conditions — the creeping of a deeper water fauna shorewards; it is specifically indicated by the conditions in the northeastern Appalachians of Gaspé. One must bear in mind that in respect to tectonic age these northeastern Devonic mountains are the earliest of the entire chain; the Appalachian folding was begun here and proceeded thence southward. In direct semblance to the relative age of these Gaspé folds are the heavy limestone beds of the Grande Grève formation in whose profuse fauna are the

species above listed, abounding in full address, companioned by an entourage which, in part, elsewhere accompanies the Oriskany, but also in part showing forth the Helderberg fauna in the dress of later evolution. Here, I take it (and have endeavored to give the demonstration in full) in these lime seas this northern Oriskany or sandstone fauna of Appalachia took its origin and thence it traveled southward through the open rias of that ancient coast into the seas within the Appalachian barriers. Here, then, was a wide open channel inward, in the northernmost of these Appalachian passages, and with the inward movement of the fauna came its differentiation and slow adjustment to the shoal waters.

In obvious contrast to this southwestern movement of the true Appalachian Oriskany faunas was the migration through the parallel channels of this northeast region lying farther to the south, one where now the Bay Chaleur indents the Gaspé coast and perhaps along others which lay between this and that equally ancient passage, the Bay of Fundy.

These are indicated by the wholly arenaceous early Devonic beds stretching across the state of Maine from Aroostook county on the east through Piscataquis and Penobscot counties to Somerset on the west. In all these shallow water channels there is a persistent and well-defined element of the Coblentzian faunas which enforces the contrast between them and the normal or standard Oriskany of New York.

The case of the Gaspé sandstone. The Gaspé sandstone is a unit of still somewhat uncertain limitations in stratigraphy, though its base is definitely understood and lies at a small unconformity with the Lower Devonic limestones. This evidence is taken wholly from the thinned northern edges of the sandstone mantle on Gaspé bay. Southward the horizontal development of the sandstones is apparently and perhaps, in places, obviously continuous in their upper part with the lower masses of sand and conglomerate which enter into the composition of the formation on the Gaspé peninsula known as the " Bonaventure," a term which appears to be correctly interpreted as Devono-Carbonic, in the sense that it embraces locally and throughout the region of its typical developments from Bonaventure island southward, a series of essentially continental deposits unconformably succeeding the marine Middle Devonic. The Gaspé sandstones of Gaspé bay contain a marine fauna which carries certain Oriskany species, *Rensselaeria ovoides* (*gaspensis*), *Eatonia peculiaris,* survivors of the Grande Grève fauna beneath, but the majority of species in the assemblage, the pelecypods and

gastropods particularly, have specific resemblances and indentities with the described species of the Hamilton (Middle Devonic) sand-shales of New York. I have so interpreted them. The suggestion, however, has been made by Professor Williams that the species of pelecypods find striking semblances among the species of the Coblentzian. We may be sure this is so, for there are similitudes running throughout the pelecypod faunas of the Devonic which are actually a hindrance rather than a help to the determination of specific values. I think, however, that the careful consideration of the Gaspé sandstone marine species can leave no doubt of their later than Oriskany age, even without the evidence from the stratigraphy. Then, further, as long ago shown by Logan and in detail by Dawson, these sandstones on Gaspé bay carry a profuse terrestrial flora of unquestionable Middle Devonic age. We have then here in the Gaspé bay region the singular phenomenon of a highly calcareous " Oriskany " whose lower beds carry the typical species of that fauna and in whose higher limestones there are still commanding representations of the fauna with additions of a later (Onondaga) type, followed above by heavy sands wherein are still surviving species of the Oriskany, themselves autocthonic, but enmeshed in an assemblage of post-Oriskany and post-Onondaga age. The fact is that with the introduction of the Gaspé sandstone begins the deposition of a widespread delta on whose outer fringe only, here and there, has a rather depauperated marine fauna been able to subsist, while the shoreward beds received the outwash of the land with its debris from the Devonic jungles. The evident adjustment of the " Oriskany " species to a gravelly bottom and in their proper place in the succession, is shown, for Gaspé, in a single known band in the Percé cliffs.

The extraordinary concurrence of the primitive Appalachian topography of the Maritime Provinces with that of today. The bays and endroits of the present Gaspé coast, like the bays and shores of Nova Scotia and Cape Breton, are the synclines and flanks of the Appalachian folds. Overridden in part by horizontal deposits in the late Devonic, the Carbonic and Permic of post-Appalachia, they have come again above the waterline by elevation and erosion and now conform the coast line and the continent to their ancient curves. The apparent return after the ages to the forms of so distant a past is in northern Gaspé not that, but the simple retention of the original form. Gaspé bay lies in a syncline as old as the Appalachian system and, in less degree, so do the

larger rivers and their barachois. There is probably no other region where so ancient a topography is still in so obvious control.

The southward spread of the sand transgression. Of the lime seas of the opening Devonic in regions which bounded the broken Siluric lands of northern South America, we have no knowledge. The basin of the Amazonas is sheeted with Devonic sands that lie close upon the Siluric limestones. The sand deposits of the Rios Maecurú, Ereré and Curuá are not far away from the Siluric limestones of the Rio Tapajos, and nowhere do we know aught of the lime sediments which represented the deeper deposits of these marine waters. They are absent or lie buried; probably the latter, for the sands are without evidence of continental character. The Maecurú sandstones are sufficiently abundant in species to indicate their part in the great sand transgression of the opening Devonic, but the specific characters of this fauna are not such as to knit them closely with Oriskany faunas of the northern continent. There are the differences which have resulted from distance, from dividing land and submarine barriers, from isolated evolution in embayments or basin seas; there are still the occasional indentities of species, more often of distinctive genera, and, all told, in the Maecurú sandstone an evident relationship in kind and time to the Oriskany-Onondaga of the north. To the German geologist, schooled in the Devonic of his own country, they are "Coblentzian" and have been so termed, with reason, by Doctor Katzer; but they are not adequately characterized by such a term; even less so than by the terms of the North American succession.

From this Amazonas basin northward, Professor Schuchert would disperse the fauna into North America by way of the Gulf of Mexico embayment to connect with the Camden chert Oriskany of Georgia. My own impression is that both the Maecurú and the Camden "Oriskany" sediments represent, by their faunas, embayments from a continental strand line which had connection with the north by way of the Appalachian channel seas, or perhaps, with even more probability, with an outer shelf strand now submerged with so much of the eastern-shore Appalachia.

We have recent knowledge of an extension westward of the "normal" Oriskany fauna of New York into a pure white limestone in St Genevieve county, Missouri, beneath it lying a well-defined Helderberg fauna. This discovery carries the distribution of the Oriskany farther in this direction than was before known. Thence to the Camden cherts of Georgia is a distance so short as to make, to express it in terms of paleogeography, but a narrow

barrier between these deposits. But the faunas in these two approximate points are still so unlike that to infer a junction of the waters across the isthmus is not yet justified. Should it so turn out that the Oriskany strand was here unbroken, we should then have the fauna completing an entire circuit in Appalachia. The St Genevieve basin at the west seems to present the duplication of the conditions in the northeastern lime basins of Gaspé, an essential exclusion of the sand from the contemporaneous deeper water. But we know too little yet of this Missouri basin to institute any satisfactory comparison between its Devonic elements and those of the northeast.

To return then to the Brazilian fauna of the Maecurú river sandstones, we may feel reasonably secure that its distance from the overspread of the northern sands, the opportunities for variations from those faunas by development under conditions of isolation, are the responsible factors for actual and apparent differences in these faunas from those of the north.

It will not do, however, to intensify these differences by statement. The affinities are obvious and they are distinctive in generic characters. In a certain sense there is in comparison with the northern Oriskany, a later tinge to the fauna; species which carry suggestions of the stage next succeeding in the New York succession. This is entirely in accordance with such expectations as we should derive from our knowledge of the Brazilian sections, for the next term above the Maecurú is the sandstone of the Rio Ererê, and its fossils, as described by their discoverers, Hartt and Rathbun, and confirmed by the evidence brought out by Derby and myself, indicate their Middle Devonic age and their rather intimate relations with the Hamilton of New York. The intermediate limestone term of the series present in the New York succession is then missing here, with our present knowledge, but the open and freer connection of this later shallow sea with the northern seas of the Middle Devonic is a very pronounced fact. In speaking of the Gaspé sandstone fauna, I have referred to Professor Williams's intimation that its pelecypods might be construed as Lower Devonic (Oriskany-Coblentzian), and I may here refer to Doctor Katzer's contention that the Ererê sandstone fauna is likewise Lower Devonic. The two suggestions are not alike in quality nor based on like argumentation, though similar in purport. Yet with close analysis of these faunas we are not prepared to concede these alternative propositions, even though at the south, the later Ererê sandstone is in direct continuity with the earlier or Maecurú. At all events, the specific and generic similitudes of these two Amazon faunas with those at

the north, greater in the later (Erèré) stage than in the earlier (Maecurú), cease and determine at these latitudes.

The austral faunas of Brazil, Argentina and the Falkland islands. The employment of the term *austral,* which I have used before as an emphatic distinction from the boreal faunas, means that in these regions under consideration and in Cape Colony as well, in other words, throughout the higher latitudes of both southern continents, there is a palpable and fundamental difference from the boreal faunas. The fact may well be stated with emphasis, but not to the exclusion of certain common bonds which declare the age of the faunas. It is well known now, was stated by Steinmann, A. Ulrich and Knod for Bolivia and corroborated by my own somewhat protracted researches upon materials from São Paulo, the Argentinian Cordilleras and the Falkland islands, that, in terms of biology, there is no Devonic in these southern latitudes except the early Devonic. Whatever the thickness of the sedimentation may be (unknown now) and whatever its lithology, it is all of an age which corresponds in paleontology to the early Devonic of the north. Whether the duration of deposition here does or does not represent only that of the northern Lower Devonic or that of the entire northern Devonic, it is perfectly clear that the fauna is one fauna and endured from the beginning to end of marine Devonic deposition. If there may have been a series of later Devonic faunas in these regions, we must say either that they were cut out by geography or cover our ignorance in the buried rocks. Professor Kayser, writing on some of the spirifers from Tibagy, in São Paulo, was among the first to indicate the quality of the Brazilian fauna, and the work of A. Ulrich and Knod in Bolivia has added confirmation to the interpretation of this Devonic.

Now that we have assembled the fauna of all these regions in reasonable fulness, the conclusion regarding the time equivalence of the entire austral fauna stands out with clarity. The Falkland sandstones, the Tibagy sands, the São Paulo lime muds, the sands of Argentina are variations in sedimentation whose exact relations in stratigraphy are not yet known, but which are knit together by a common biology. An obstacle to the solution of the real character of the paleontology here has been the natural impulse on the part of students in this field, bringing to their interpretations an acquaintance with the boreal Devonic, to enforce parallels and identifications of southern with northern species — to squeeze the unknown into the moulds of the known — a customary and often an almost imperative procedure.

The composition of this austral Devonic fauna, on close analysis, brings out the evident fact that, whatever its origin, it has developed its peculiar characteristics under the influence of isolation from the other Devonic basins and shelf-seas of this stage. In South Africa it may be demonstrable on further evidence that the same fauna was preceded by a period of continental deposition properly included within the Devonic system. But in either case there is no indication that the primary calcareous term of the northern Devonic, by its absence in the south, is to be regarded as a factor of any weight whatsoever in estimating the relative stage of the austral fauna. In the Falkland islands, where the affiliations of the marine fauna are more intimate with that of the Bokkeveld beds than with the nearer South America fauna, there fails as yet any evidence of a preliminary Devonic deposit of continental character.

These extensive and reasonably profuse faunas of the southern Devonic strands developed along a continent obviously separated from that at the north, and for most of its extent widely by equatorial Atlantic waters, but narrowly in the subequatorial latitudes of Brazil, where the Amazonas faunas, with affiliations toward the north, lie not far away from the Devonic beds of Matto Grosso with evident alliances with the south. The marine Devonic was the strand of a Pre-Gondwana land of whose constituent sedimentary rocks we know little save for the occasional dredging of altered sediments from the Atlantic bottom, the gneissoid inclusions in the deep-seated lavas of the mid-Atlantic islands, and perhaps some part of the crystallines of the southern islands, South Georgia, the South Shetlands and of Antarctica. To these are to be added the South African premarine Devonic series capped by the Table Mountain sandstone, now regarded by some writers as of glacial origin, and, of course, some part of the Precambric crystallines of South America and Africa.

Our present knowledge leads us to the conception of an Andean Siluric and Cambric land reaching far to the north along the Cordilleran rib, for the limestones of eastern Argentina, Bolivia and Peru carrying *Liorhynchus bodenbenderi* and its associated fossils, are Siluric, not Devonic. The stretch of the Devonic strand along the Cordilleran rib far to the north is now well known and there is every reason to believe that the Pre-Gondwana land which traversed the south Atlantic extended an arm well to the north on the Pacific side. Pre-Gondwana land was thus a very ancient austral continent, and wholly comparable in extent and age to Laurentia at the north. The latter, in days before the Caledonian folding, traversed

the north Atlantic basin, just as the former, perhaps more insulated but of wider extent, stretched across the south Atlantic from southwest northeasterly.

Problem of the black shales. The Upper Devonic of Appalachia is eminently characterized by its abundance, often preponderance, of black shale beds. These are thickest in Michigan, Ohio, Tennessee and Kentucky and seem to thin continuously eastward into New York. Not all students have agreed in construing the entire heavy mass of these bituminous shales as Devonic, but the upper divisions (Chattanooga shales) have been, with some reason, assigned to the opening stage of the Carbonic. It is probably true that these shale bands have been studied most closely in New York where it is evident that they represent the thinning edge of the body of this sediment. Here the upper black shales of the Genesee and Portage groups have caught more abundantly than elsewhere the characteristic marine fauna of the intercalated deep water marine. A customary interpretation of the origin of these black Devonic shales was that of shallow water origin. This conception assumed, largely on the basis of the plant remains in which the rocks abound and especially the accumulations of sporiferous deposits occurring in the Ohio beds, that they were near-shore beds formed in shallow basins with choked outlets. Another popular explanation was to refer them to the accumulation of fat muds beneath a Sargasso sea. Both interpretations, twenty years ago, were accepted alternatively without special scrutiny. At a later date the writer had occasion to give attention to the problem and in seeking a solution brought out the very evident fact that the known seaward sweep of terrestrial vegetation by rivers of the land into the rivers of the ocean, the abundance of such distant flotsam observed by oceanographers, failed to compel any such interpretation as the first, while the Sargasso sea conception is entirely eliminated by the nature of the flora of these shales, which is wholly terrestrial. The Genesee and Portage black shales, furthermore, were shown to carry a highly characteristic marine fauna, whose elements show a deep water habitus.

These older conceptions have the merit of the obvious and specious. There are, however, deeper considerations which have been brought out with some degree of analytical force and which are not in harmony with this interpretation of a shallow water origin for these extensive deposits. If I am not mistaken, it was Professor Williams who first directed attention to the fact that in all the bituminous shale beds of the Appalachian Paleozoic succes-

sion — the Utica shale of the Ordovicic, the Marcellus of the Middle Devonic, and these Genesee-Portage shales of the Upper Devonic — there is throughout a common character in the aspect of the contained marine fauna. Deficiency of lime makes all species thin shelled; all species are of rather depauperated size, phosphatic brachiopods (*Lingula, Orbiculoidea* etc.) abound while the lime-shelled species are few, small cephalopods are frequent while other Mollusca are rarer and fragile. The statement is only a natural expression of the effect of like conditions on various faunas.

1 The faunas of the Genesee-Portage are strictly marine;

2 They are, taken as a whole, of the deep water type whi.h emphasizes the Portage fauna in its highest development (Intumescens fauna); indeed, they represent this fauna;

3 The shales carry a thin lime deposit, continuous over a great extent of latitude and essentially a mass of pteropods. I have indicated that this Styliolina or Genundewa limestone holds the pteropod Styliolina in numbers of 50,000 — 100,000 to the cubic inch. By analogy these minute creatures are pelagic open sea animals. These limestones, too, carry the Intumescens fauna in a typical though prenuncial development;

4 The shales abound in exudations of FeS_2; indeed, the base of the Genesee shale in western New York rests on a continuous layer of pyrite extending for 100 miles and carrying the relicts of a fauna (Hamilton) dismally dwarfed by the foul conditions which it hopelessly tried to survive.

These features of the fauna and their physical surroundings I have found illuminated by the parallel conditions prevailing in the depths of great inclosed seas like the Mediterranean and the Black Sea, where limeless waters, free liberation of sulphur in connection with a rapid organic decomposition under great pressure, are producing such foul bottoms with sulphide compounds, dwarfed and thin-shelled Mollusca, always, of course, with the accretion of what may fall in from flotage and dying pelagic life. These inferences as to the deep water origin of the black shales are corroborated by their greater thickness westward of New York.

In extraordinary contrast to these conclusions is the proposition put forward by Professor Grabau that the bituminous shales are delta deposits, brought in by a putative southwestern river flowing northeasterly, discharging this singular supposed fluviatile-continental mass over an area of many hundreds of square miles. This view seems to the writer the extreme expression of a recent obvious tendency to magnify the part contributed by alluvial floors and fans, desert desiccation and other continental factors to the upbuilding of the geological column.

The Old Red Sandstone. The conception of these beds as to origin is now rather definitely formulated. Through years of wavering interpretation we have reached a point at which we may concede the essential continental origin of most of the deposits which may be fairly embraced under the designation above employed. The force and proof of this conception is largely due to the effective work of Professor Barrell, who has attacked the problem from an angle new to the usual approach. The Catskill formation of the Appalachians and the Oneonta sandstone which lies at or is continuous with its western base, are, according to this interpretation, the outwash or delta plains composed of the debris of the more easterly lying mountainous lands, now either completely lost beneath the eastern sea or represented only by their metamorphosed roots.

I think that for the interpretation of these great delta plains fringing the interior sea of the Upper Devonic, too little emphasis has been laid on the tremendous mid-Devonic mountain making all through the northern Caledonid Appalachians — a time of orogenic revolution which greately overpassed in energy that of any other period in the history of the mountains. With the opening of late Devonic time, all through this region there were the newly made mountains rising to fresh heights and inviting the most vigorous attack of meteoric waters; inviting, too, as a natural consequence, the formation of such tremendous plains of continental debris all along the shore lines.

There must have been on the now buried eastern shores of Appalachia, deltas of similar origin and extent to those we now know on the western shores. While the general proposition is a closed one and we may find satisfying explanations of all the phenomena presented by the accumulation of continental material on the edges of a marine basin, with all necessary accompanying phenomena of interdigitation of deposits, local repulse and invasion of marine faunas, etc., there still remain some open questions as to the scope of the continental factor, in time, and as to its exclusiveness in effect.

Does the Catskill formation, in its typical development in the Catskill mountains of New York, represent exclusively Devonic sedimentation, or does it transcend the Devonic boundary? Assumption commonly favors the former, but there are outside evidences that indicate the latter presumption, drawn from a consideration of the Bonaventure conglomerate.

Bonaventure conglomerate. This mantle of sandstone and conglomerate sheets the present coasts of the northern Maritime Provinces of Appalachia, seldom extending inland in its region

of typical development. It was commonly regarded by earlier observers as lying unconformably on the Gaspé sandstones and by Logan, who first described and named it, as a Carbonic formation. I have made reference already in speaking of the Gaspé sandstone, to the presumable horizontal continuity of the two, the upper beds of the former with the lower beds of the latter, intimating thereby no interruption of deposition though with an evident change of coast line and drainage.

In fact, in this respect, in the northernmost extent of the Bonaventure formation and the southernmost of the Gaspé sandstone, the relations presented are similar to those of the early Catskill stage and the marine Devonic (Ithaca) of the westward seas. In southern Gaspé and thence into the lower gulf, the Bonaventure lies everywhere atop of the almost vertical Siluric-Ordovicic limestones and, in places, on the equally upturned Lower Devonic. So here again in this Bonaventure formation is the evidence of great land waste from the folded early Devonic mountains, obviously from a land eastward of the present coast. The conglomerates of the Bonaventure carry fossiliferous pebbles and boulders of all the earlier formations, those of the Lower Devonic being of greatest abundance, but with exception of these last the boulders are largely from beds unfamiliar to the present land. I am not yet satisfied that any of these boulders which have come under my observation are ice-scratched, but many of them are very large and occasionally one will weigh several hundred pounds. Indeed, Sir William Logan records one of them which weighed a ton. We are not justified yet in appealing to the action of any other agencies in accumulating these, except continental water and shore ice with the addition of the work that would be done along the higher coasts of the mountains, on its headlands and promontories by the pounding of the sea. To the latter I believe we must ascribe a definite part in the work of building the formation.

The evidence that the Bonaventure transcends Devonic time is largely negative; it lies on no fossil evidence, though plant remains of still undetermined character are scattered through the sand beds. But in this region it represents all the rest of Paleozoic time that is recorded by the rocks, and what part of the pile may be Carbonic must be determined from the study of the still little known accumulation of this continental waste which sheets New Brunswick.

At Migouasha or Scaumenac bay at the head of the Bay Chaleur, there is a different expression presented in the gray and more cal-

careous sand cliffs carrying the extraordinary profusion of Ostracoderm and Crossopterygian fishes and beautifully preserved ferns. The plants are natural land wash while the fishes are presumably the natives of the stream mouths, probably migrant into the fresh waters for spawning purposes, like the salmon which today maintain this historic procedure in the streams which traverse these rocks. Beneath these remarkable cliffs is a gray boulder shale whose boulders are more largely of the fossiliferous limestones and less of the crystallines than in the Bonaventure. We are not yet prepared to be positive regarding the origin of this underlying boulder shale. Its matrix resolves easily to clay and squeezes out over the landwash, setting its boulders free. Its component blocks are fractured, impressed and ice-scratched. The students of the fish-bearing *Magouasha beds* above are quite in accord in regarding them as of Upper Devonic age, though this conclusion has not as yet full confirmation from the other biotic elements.

The late Doctor Ells found evidence satisfactory to him of an unconformity within the mass of the Bonaventure conglomerate which was assumed to divide the time of its deposition by a slight diastrophy. If this interesting division can be fully demonstrated, it establishes a very noteworthy agreement with the Old Red of northern Scotland which is marked by a widespread disconformity of this kind.

Origin of the Intumescens-fauna. It was essentially with the help of Professor Kayser's studies of the "Intumescens fauna" of the Upper Devonic, that the writer prosecuted his investigations of this fauna in America. The "Intumescens-fauna" of the Genesee-Portage stage has proved to have had a profuse and highly characteristic development in western New York, though quite suddenly losing itself thence in all directions. Eastward its place is taken in contemporaneous strata by the brachiopod faunas of the Ithaca and Chemung groups, so that no evidence of its existence is to be found on the western shores of old Appalachia. Westward traces of it are found here and there, in Iowa, in Manitoba, a striking development in Montana. The fauna, it was claimed by the writer, took its origin from the region of its great development in northern Siberia (Timan), and its dispersal was eastward along American strands into the interior sea of early Upper Devonic Appalachia where, favored by its isolation, it burst out into a fulness of development. Professor Schuchert, in the construction of his paleogeographic maps, has felt it necessary to introduce this fauna from

the east through a putative passageway across Appalachia, in northern New Jersey. Paleogeography makes many tentative demands of its followers. The writer could never visualize this gateway and Professor Barrell, after long study, has hung over it the sign: "Closed."

The extent of Devonic intra-Appalachian vulcanism. Outside the western hemisphere, volcanic activity was widespread during the early Devonic. The interior Devonic basin of North America has been regarded as almost devoid of such activities and, from South America, we have no present knowledge of volcanic outflows in the sheet of Devonic sediments. The contrast in this regard between the basins or intermontane channels of the northeast Appalachians and those farther south is very marked. Rhyolitic ashes and scoriae interlaminate the marine Lower Devonic of Dalhousie; volcanic dikes traverse the lower limestones on the Grande Grève peninsula; the Gaspé sandstone is cut in several places by such dikes and the Bonaventure formation is locally overwhelmed by lava outpours. New York and the interior region are not wholly without such evidences — dikes of alnoite penetrate the Upper Devonic near Ithaca, serpentinized peridotite forms dikes which traverse the Siluric and Devonic about Syracuse; dikes of like character, in an extensive parallel series, cut the Ordovicic of the Mohawk valley and may have penetrated, in all probability did, a once overlying Devonic mantle. These dike intrusions, however, are along preexistent fault or joint lines, all accessory to the orogenic structure of the eastern mountains. In other forms than this, vulcanism, it has been generally regarded, does not manifest itself in these Devonic areas of the interior.

Over the St Lawrence lowlands lying between Montreal and the New York-Vermont boundary, is an array of volcanic stacks and domes varying in size and effect from the most majestic in Mount Royal, to the lesser ones at the south; all of which have been termed by Doctor Adams, the "Monteregian Hills." These are lavas in various stages of differentiation but all have obviously penetrated a great plain of Ordovicic (Lorraine) shales. There is, however, a definite indication of the age of these intrusions presented by the contact breccias known on St Helen island near Mount Royal, in which are fragments bearing unquestionable Lower Devonic fossils; fixing thus the age of the lava intrusions as at least post-Lower Devonic. These blocks in the breccia are the only known trace of the Devonic in all this region, from the St Lawrence southward into

the mountain folds of New Hampshire, and the inevitable conclusion is before us of their former existence here and present almost total destruction.

Quite outside of this Monteregian province ("a petrographic province," Adams), about 150 miles to the south within the State of New York, lies the volcanic plug known, from its historic associations, as "Stark's Redoubt." This volcanic mass, very limited in width and extent, has been the subject of much study and discussion. Apparently it is a basic pillow lava, deeply serpentinized and having the aspect of a kimberlite with a surprising amount of free carbon. It seems to be interbedded with "Hudson River" shales which at this point are of Ordovicic age, but the mass is sheared and the shales faulted against it and there is little doubt that the lava transected the lower part of the shale beds. In our present knowledge of the former extent of the Devonic rocks, in New York at least, beyond their actual outcrops; our necessary admission of their removal over tremendous areas by ice erosion; in view of such evidence of great loss as is brought out by the arctic distribution of these rocks (see next caption), and, for specific example, by the great upstanding edge of the Helderberg escarpment in New York whose abruptly cut-off edges face the great north where once its undiminished sheets of strata must have extended but where today no trace of Devonic has survived; such evidence approves the conception that the "Stark's Redoubt" volcano, like the Monteregian Hills, is of like origin and date — not earlier than Lower Devonic, and like them a manifestation of the igneous intrusions and outpours which characterized the Caledonid type of Devonic orogeny.

A world of knowledge regarding the distribution of Devonic seas and faunas awaits us from both Arctic and Antarctic America. No fields, perhaps, are left where so important clues are buried and though these lie under a grievous load, they nevertheless beckon most alluringly to the hardy spirit. The suggestive geologic data brought away from Antarctica first by Eights of Albany and more than three-quarters of a century later by Shackelton and the lamented Scott forecast the light from these Cimmerian latitudes. The remarkable collections gathered from Arctic Ellesmere-land by Doctor Schei of the second "Fram" expedition, intimated an extraordinary development of Appalachin Devonic in the high north

Meyer, Loewe and Holtedahl, who have worked out the paleontologic factors of this Devonic succession, have demonstrated a highly developed series beginning with an actual representation of the calcareous members, the Keyser (or introductory unit of the Maryland succession), the Coeymans and New Scotland members of the Helderberg, and so on upward with a final Devonic member carrying terrestrial plants in a continental sediment.

These important discoveries compel us once more to reconstruct the paleogeographic map, for the most obvious conclusion derived from these data is the direct and immediate connection of fairly deep arctic marine waters with the interior seas of Appalachia. The Siluric bay, which has been made to reach its long way southward from the Arctic into the interior and has been conceived to have brought thence its faunas, reached up rather than down, and its waters were not shrunken at the close of the Siluric by a northern positive movement of the land. Palpably, as Doctor Meyer has suggested, the Devonic water way to the north must have been wide open all about these western and northwestern shores of the great Laurentia; and if the Devonic strata fail to appear there in the interval between New York, southern Ontario and Ellesmere-land, it is either because their remains still lie unrevealed or have been swept away by heavy erosion.

NOTES ON THE INTRAFORMATIONAL CONTORTED STRATA AT TRENTON FALLS

BY WILLIAM J. MILLER

INTRODUCTION

In 1908 the writer published a short paper in the Journal of Geology [1] describing the contorted strata within the Trenton formation at Trenton Falls in central New York and offering an explanation of the phenomena.

Recently (1913) there has appeared an elaborate paper by the late F. F. Hahn in the Neues Jahrbuch für Mineralogie, Geologie und Paleontologie [2] in which the contorted strata at Trenton Falls are particularly discussed and an entirely different explanation is offered for the phenomena there, as well as for apparently similar phenomena in certain other parts of the world.

Grabau [3] (1913) discusses the contorted zones at Trenton Falls and similar phenomena elsewhere and fully accepts Hahn's explanation, but he neither states nor presents arguments against the present writer's hypothesis.

It is not the present purpose to consider intraformational corrugations in general, but rather to confine attention to such features as are to be observed at Trenton Falls. It will be shown that Hahn's explanation can not apply there. It is generally agreed that intraformational contortions may be produced in several ways, and the present concern is to find the correct explanation of the cause of the particular phenomena at Trenton Falls. For certain details not repeated in this paper, the reader should consult the two papers above cited.

THE CONTORTED ZONES WITHIN THE TRENTON FORMATION

Excellent examples of highly folded or contorted strata between nonfolded strata may be seen along the sides of the gorge at Trenton Falls where the disturbed beds occur at two very distinct

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[1] Highly Folded Between Non-folded Strata at Trenton Falls, N. Y. Jour. Geol., 16: 428–33.

[2] Untermeerische Gleitung bei Trenton Falls (Nordamerika) und ihr Verhältnis zu ähnlichen Störungsbildern: Neues Jahrbuch. 36: 1–41, 1913.

[3] Principles of Stratigraphy, p. 783–84.

horizons within the Trenton limestone. The lower contorted zone, whose base lies 144 feet below the top of the Trenton, is from 4 to 6 feet thick. It is visible only near the crest of the lower part of the High fall (see accompanying plate) and in the upper end of the gorge near Prospect village where the strata are highly inclined. The upper contorted zone, whose base lies 65 or 70 feet below the top of the Trenton, is from about 5 to 12 or 15 feet thick. It is well exhibited along the path opposite High fall from which point it may be traced along the sides of the gorge for nearly 2 miles to Prospect.[1]

The impure limestone layers of both the folded and nonfolded portions average only a few inches in thickness and are separated by thin bands of shale. Within the folded zone horizons the layers are, in some cases, scarcely folded or broken; sometimes they are gently folded or tilted; while most commonly they are highly folded and fractured (figure 1).

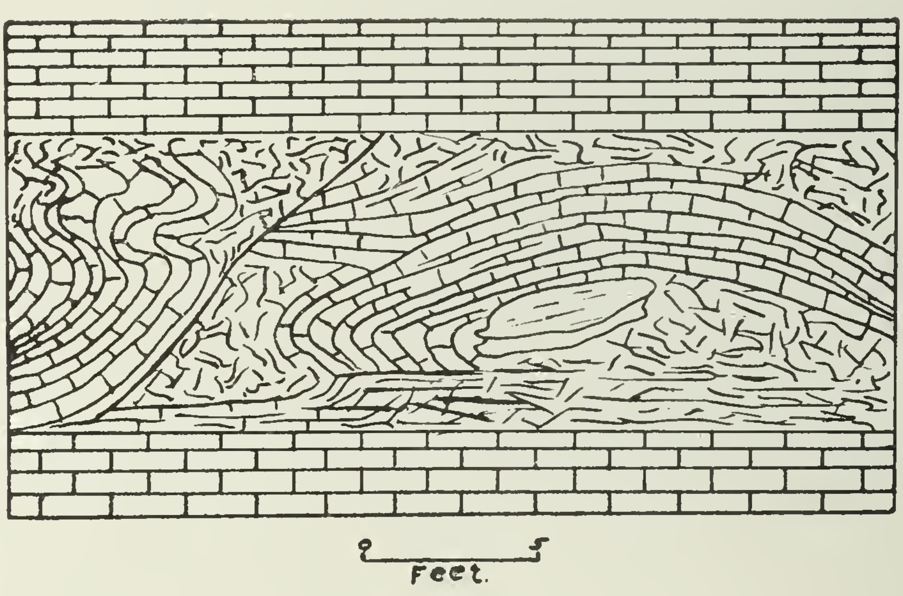

Fig. 1. The upper contorted and broken zone as seen along the footpath opposite the crest of High fall at Trenton Falls. Drawn from nature.

Numerous observations show the strikes of the contorted zone folds to be from N. 50° E. to N. 65° E. or practically parallel to the strike of the distinct folds in the Trenton formation in this region, as well as parallel to the strike of the well-defined fault-fold line passing through the village of Prospect (see geologic map).

It should also be noted that these contorted strata occur only in a very local district. As far as they can be ascertained they are

[1] The interested reader should consult the writer's geologic map of the Remsen quadrangle in N. Y. State Mus. Bul. 126.

T. G. White, photo.

The lower contorted and broken zone as seen near the crest of the lower part of High fall, at Trenton Falls

visible only in the Trenton Falls gorge and in the bed of Cincinnati creek 1½ miles southwest of Prospect.

HYPOTHESES REGARDING THE CAUSE OF THE CONTORTIONS

Tectonic hypothesis. The explanation offered by the writer is that the contorted zones were produced by differential movements within the mass of the Trenton limestone. The displacement (140 feet) of the thrust fault at Prospect village was sufficient to cause the beds of the middle Trenton to slide over beds of the upper Trenton. Near the fault-surface the strata on the upthrow side are bent upward at angles of from 30 to 40 degrees. Figure 2 shows the relation of the folded zones to this fault.

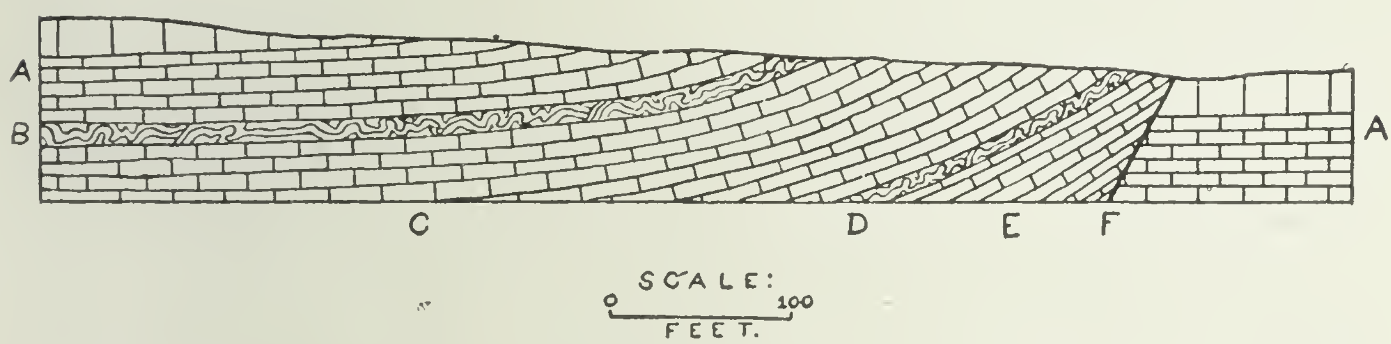

Fig. 2. Section showing the position of the two corrugated zones within the Trenton formation and their relation to the thrust fault at Prospect, near Trenton Falls

It is easy to see how, when the force of compression was brought to bear in the region, the higher Trenton beds on the upthrow side must have moved more easily and consequently faster than the lower Trenton beds. For instance, the portion A in figures 1 and 2 being separated from C by an intermediate mass B of possibly slightly less rigidity would slide over C and cause the portion B to become ruffled or folded and fractured. Occasionally parts of zone B would be moved very little or would be moved along without being folded. The portion B would need to be only very slightly less rigid than the adjacent portions. The somewhat thinner limestone layers separated by thicker shale partings would cause the part B to be thus less rigid. A similar explanation applies to the lower folded zone, and the folded or contorted zones thus merely indicate horizons along which the differential movements have taken place.

Some of the points favoring this tectonic hypothesis are as follows:

1 The very existence of the thrust fault at Prospect and the distinct folds in the Trenton formation just to the south make it certain that there must have been differential movements within the mass of the formation.

2 Contorted zones are known to have been produced by differential movement of more resistant beds over weaker beds in various regions of folded rocks (for example, Marquette district of Michigan).

3 The parallelism of the strike of the folds of the Trenton formation with that of the fault at Prospect.

4 The parallelism of the strikes of the small folds and faults of the contorted zones with the strikes of the larger folds and the fault at Prospect.

5 The limitation of the contorted zones to the upthrow side of the only considerable thrust fault in the Paleozoic rocks of central New York.

6 The absolute limitation of the contorted zones to two very definite horizons in the Trenton formation instead of there being masses of disturbed strata irregularly distributed through the formation.

7 The worn character of the upper and lower surfaces of the contorted zones marked by layers of limestone sharply broken across and the presence of numerous fragments of limestone.

8 The corrugations could not have been produced before deposition of the overlying masses because (*a*) the limestone layers at least were comparatively hard and brittle when contorted, as shown by the numerous sharp breaks; (*b*) there is no evidence of very irregular or crumpled upper surfaces of the contorted zones with sediment deposited in the irregularities or depressions; and (*c*) any attempt to explain the contortions as due to slumping of masses on the sea bottom is utterly opposed by the low angle and direction of slope of the sea bottom as brought out below, and the remarkable thinness and considerable extent (2 miles) of the contorted zones.

9 Experimental evidence clearly suggests the possibility of production of contorted zones by such differential movements.

Hypothesis of submarine gliding. According to Hahn, the contorted zones at Trenton Falls are excellent examples of phenomena which have been produced by sliding or slumping of masses on a sloping sea bottom during the process of sedimentation. The accompanying diagram (figure 3) will serve to illustrate the principle.

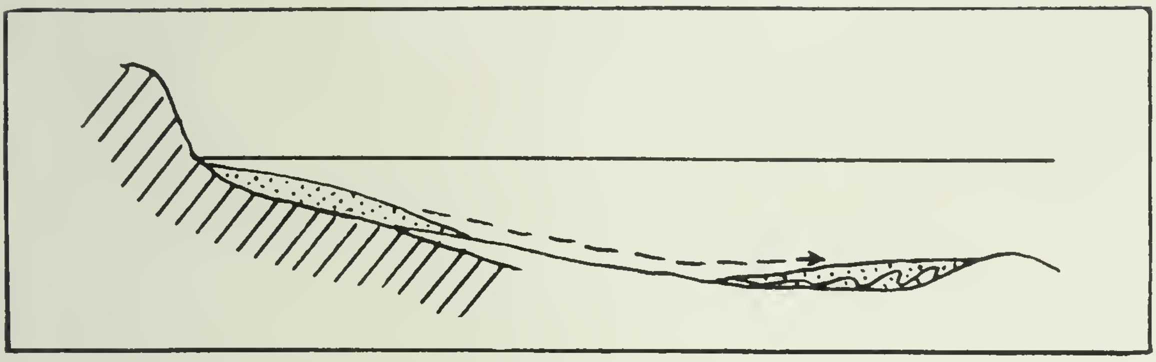

Fig. 3. Diagram illustrating Hahn's hypothesis of submarine slumping

A lenslike mass breaking loose from any cause (for example, earthquake shock) would glide down the submarine slope and, because of increased friction and water pressure and the striking of some obstacle on the sea bottom, the gliding mass would come to rest only after it had become considerably deformed or contorted, as shown in the diagram. Sediments would then be deposited in normal order over the crumpled layer. The most intense folding would be toward the front of the transposed mass and of course the strike of the folds would be at right angles to the direction of movement of the sliding mass. Conditions for such submarine gliding are regarded as favorable at many places along the marginal sea bottom.

Some of the points supporting this submarine sliding hypothesis, according to Hahn, are as follows:

1 Observed production of contortions by subaqueous gliding, for example, that in Lake Zurich 1875.

2 Various portions of the sea bottom are known to have slopes of from 4 to 18 degrees or more which would be sufficiently steep for masses to slide down under certain conditions.

3 The texture (character) of materials within the contorted zones is essentially the same as that of the underlying and overlying materials, and hence the disturbed zones were not horizons of weakness which were distorted under pressure.

4 The analogy of the Trenton Falls contorted zones with those of certain other regions.

5 Tectonic contortions are pressure phenomena produced under heavy loads.

6 The corrugated zones are not of tectonic origin, that is, due to differential movements within the Trenton limestone because of (*a*) absence of stretched or flattened out masses; (*b*) absence of distinct slickensided or streaked surfaces; and (*c*) absence of fragments of both the underlying and overlying masses within the disturbed zones.

7 No clear drag or gliding zone is visible, but rather there is often gradual transition between the contorted zones and the overlying strata.

DISCUSSION OF THE HYPOTHESES

Certain points not mentioned above as well as others requiring fuller discussion will now be considered. It is not the purpose of this paper to deny that, under proper conditions, subaqueous slumping, with resulting contortions, may take place, but it is our concern to show that the contorted zones at Trenton Falls do not admit of such explanation.

An important fact, which in itself is well-nigh fatal to the hypothesis of submarine slumping, is that the slope of the sea bottom on which deposition of the Trenton beds took place was altogether too slight. The writer has presented detailed evidence to prove that, in the Trenton Falls district, the sea bottom receiving Trenton deposits was remarkably smooth and with greatest slope toward the southwest at the rate of only 6 to 20 feet a mile.[1] Similar evidence for the adjoining Little Falls[2] and Port Leyden[3] districts by Cushing and the writer show respective slopes of only 6 to 10 and about 30 feet a mile. Considering a slope of 12 or 15 feet a mile at Trenton Falls, this is 30 to 40 times less than the slope (4 to 6 degrees) in Lake Zurich, which Hahn cites as a remarkable instance of very slight slope upon which slumping occurred. In fact the floor of the Trenton sea in the vicinity of Trenton Falls was so nearly perfectly horizontal that any such slumping or gliding of masses, as required by Hahn's hypothesis, could not have taken place.

But, even if we grant the possibility of submarine gliding, another difficulty stands in the way, namely, that the gliding masses, as judged by the obvious criterion of strikes of small folds within the contorted zones, must have slumped off toward the northwest when, as a matter of fact, the greatest slope of the sea bottom was at right angles to this, or to the southwest.

Emphasis is placed by Hahn upon the fact that the materials of the contorted zones are not notably different (weaker) than the inclosing materials. While differential motions would certainly tend to concentrate along distinctly weaker belts, such belts are not deemed absolutely essential because the slipping once having even

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[1] N. Y. State Mus. Bul. 126, p. 36.
[2] N. Y. State Mus. Bul. 77, p. 61.
[3] N. Y. State Mus. Bul. 135, p. 43.

a little start, as along two horizons within the formation, any renewed or continued movement would tend to follow the same horizons. It is at least significant that the contorted zones occur in the weakest portion of the Trenton formation; that is, where the soft shale partings are the most pronounced.

Replying to the statement that tectonic contortions are pressure phenomena produced under heavy loads, it may be said that, in the light of comparatively recent investigations, a great overlying load would not be necessary in order to permit the development of folded and faulted structures such as those in the contorted zones at Trenton Falls, particularly since the strata are alternating thin layers of unaltered limestone and soft shale. No doubt considerably more overlying rock was present during the folding and faulting process than now. Distinctly stretched or flattened out masses would scarcely have been produced under the pressure conditions which obtained.

In contrasting folds of the zones of fracture and flow, Leith clearly states[1] that there is "little slipping between the beds" in the zone of flow, while there is "much slipping between the beds" in the zone of fracture. The deformation of the strata at Trenton Falls certainly took place in the zone of fracture as proved by the very existence of the sharp thrust fault and the fractured character of the rocks within the contorted zones. Considering also the thick partings of soft shale, it is readily seen that the conditions were very favorable for slipping between the beds or differential movements of the strata.

Hahn also emphasizes the point that slickensides should be very evident according to the tectonic hypothesis. While it is true that some slickensides occur within the disturbed zones, nevertheless they are not very evident at either the tops or bottoms of those zones. When it is remembered that the Trenton consists of alternating soft shales and comparatively hard limestones, it is easy to see how the sliding must have taken place along the bands of soft shale which were more or less crushed but not notably slickensided. In spite of the lack of direct evidence from slickensides, the writer believes that the multitude of sharply broken limestone fragments (apparently not recognized by Hahn) toward the tops and bottoms of the disturbed zones, as well as within them, clearly supports the view that there has been actual rubbing (sliding) of the masses of the disturbed zones against both the overlying and underlying masses. Even if we should grant Hahn's argument concerning lack

[1] Structural Geology, p. 111.

of slickensides, this same argument applies against his own hypothesis, at least as regards the under sides of the disturbed zones. Thus, when the disturbance took place the limestone layers not only were contorted but were hard and brittle enough often to break sharply and rub over each other with occasional evidence of slickensides, and it is quite reasonable to ask why the sliding of large masses of relatively hard rock on the sea bottom took place without leaving distinctly streaked or slickensided gliding surfaces.

The statement that instead of clearly defined drag (or gliding) surfaces there is often gradual transition between the contorted zones and overlying strata may be answered by saying (*a*) that the writer's observations show rather sharp separation between the disturbed strata and overlying undisturbed strata to be quite the rule (see figure 1 and accompanying plate); and (*b*) that the few blocks of apparently undisturbed rock within the horizons of the disturbed zones are blocks which either were moved *en masse* without being crumpled or they are blocks which may have moved relatively little, if any, while the overlying strata slipped along. Blocks of this latter class would have acted as local buttresses against which the deformed layers may have piled up to thicken locally the disturbed zones. Thus, along the footpath just south of the railroad bridge, the strata seem to be in normal order; then passing southward, there are masses of tilted and broken strata forming a zone of unusual thickness (10 to 15 feet); and finally, just opposite the High falls, the highly contorted and broken zone occurs with thickness of 5 to 8 at the same horizon. Such an arrangement of masses within the horizon of a contorted zone is quite in harmony with the idea of northwestward differential movements.

The very local occurrence of the phenomena in proximity to the thrust fault at Prospect and the remarkable coincidence of the strikes of this fault, the distinct folds in the Trenton formation, and the folds and fractures within the contorted zones are facts not to be lightly brushed aside by saying: "Precisely the local occurrence of the phenomenon which Miller emphasizes appears to me to be out of harmony with his explanation. The cited parallelism of the movements is moreover in no sense proof, since to be sure the E. NE-W. SW, or in general E-W, direction already governed the Prepaleozoic Adirondack mass, consequently the later movements followed only an inherited character."[1] The present writer fails to see how either the pressures within or the direction of the Prepaleozoic mass in any way whatever argues against the idea

[1] Hahn: Neues Jahrbuch, 36:8. 1913. Freely translated from the German.

of differential movements within the Trenton formation due to lateral pressure at the time of the thrust faulting.

The submarine gliding hypothesis, as set forth by Hahn, may well enough be the correct explanation of intraformational corrugations in certain regions but, as above shown, there are insuperable difficulties in the way of applying this hypothesis to such phenomena at Trenton Falls. It would seem that Hahn has fallen into a common error of making a single hypothesis or explanation altogether too inclusive in its scope.

THE GREAT RIFT ON CHIMNEY MOUNTAIN

BY WILLIAM J. MILLER

THE MOUNTAIN AND ITS LOCATION

Chimney mountain lies 7 miles south-southeast of Indian Lake village in the Adirondack mountains and in the northwestern portion of the Thirteenth Lake quadrangle of the United States Geological Survey. While making his headquarters at Indian Lake during the summer of 1914, the writer's attention was repeatedly called to a rather remarkable feature toward the top of the mountain and variously ascribed to "some convulsion of nature," "volcanic action," or the "splitting open of the mountain." This paper very briefly gives the results of an examination of the locality, and it is in fact not much more than an explanation of the accompanying plates and figures.

Chimney mountain has two summits about a fourth of a mile apart, the eastern point reaching an altitude of 2705 feet, and the western point about 2640 feet. The Hamilton-Warren county line passes across the mountain between these two summits. Facing the west, the mountain side is very steep with a descent of 900 feet in a half mile.

THE GREAT RIFT

The phenomenon of special interest is a great rift with strike N 20° E directly across the eastern summit of the mountain (see plate 1 and figure 3). Exact figures were not determined, but the rift has an estimated length of 600 to 700 feet; maximum depth of 200 to 250 feet; and maximum width across the top of 250 to 300 feet. On the eastern side of the chasm, the wall is very steep to almost precipitous, while the greatest angle of the slope on the western side is about 50 degrees. The highest point is the summit of the so-called "Chimney rock" which rises pinnaclelike on the eastern side of the chasm (see plate 2) and some 50 or 60 feet higher than the highest portion of the western side of the chasm directly

opposite. In the bottom of the rift and also at the eastern base of the Chimney rock mass there are great accumulations of angular blocks of rock, often 10 to 20 feet across, which have rolled down the steep slopes since the development of the chasm.

The fact that, not many years ago, a forest fire made an almost clean sweep of the vegetation from this portion of the mountain causes the chasm and its immediately surrounding rock masses to be very plainly visible.

THE ROCKS

All the exposed rocks are of Precambric age, the main mass of the mountain consisting of fairly homogeneous, moderately gneissoid, granitic syenite, with Grenville strata resting against the western side. The rift is wholly developed within the Grenville strata, which there have a visible thickness of about 250 feet. These rocks, which are very distinctly stratified in layers from 6 inches to 4 or 5 feet thick, are rusty looking biotite-quartz-feldspar gneisses, greenish-gray pyroxene (coccolite)-feldspar gneisses, and some beds of quartzite.

On the western side of the chasm the rocks strike N 20° E or parallel to the rift and dip 50 degrees westward, this strike and dip being uniform down the whole western face of the mountain. On the eastern side of the chasm the strike and dip are quite different, being N 40° W with greatest dip (at Chimney rock) of 20 degrees toward the northeast.

It is important to note that in spite of such marked differences in strike and dip, the rocks on opposite sides of the rift are of exactly the same character in every respect, and it is certain that they were once parts of a continuous mass.

Prominent joint-planes, mostly approximately at right angles to the bedding planes, are common, so that frequently large joint-blocks loosen and slide down the steep slopes.

The exact character of the Grenville strata immediately beneath the exposed gneisses just described is not known though, as will be explained below, they are quite certainly relatively weaker rocks. That they are probably either limestones or at least limestone (or calcareous) strata interbedded with gneisses is strongly suggested by the fact that Grenville beds very similar to those of Chimney mountain are often directly associated with limestone in the central and southern Adirondacks, such association having been frequently observed by the writer in the vicinity of Indian Lake village and in the valleys between that village and Chimney mountain. At the

W. J. Miller, photo.

Looking northward through the great rift on Chimney mountain, with Chimney rock on the right

W. J. Miller, photo.

View of Chimney rock as seen directly across the rift from the highest point on the western side

bottom of the chasm, where one would expect to get some clew to the character of the underlying strata, the heavy covering of rock debris conceals everything.

CAUSE OF THE RIFT

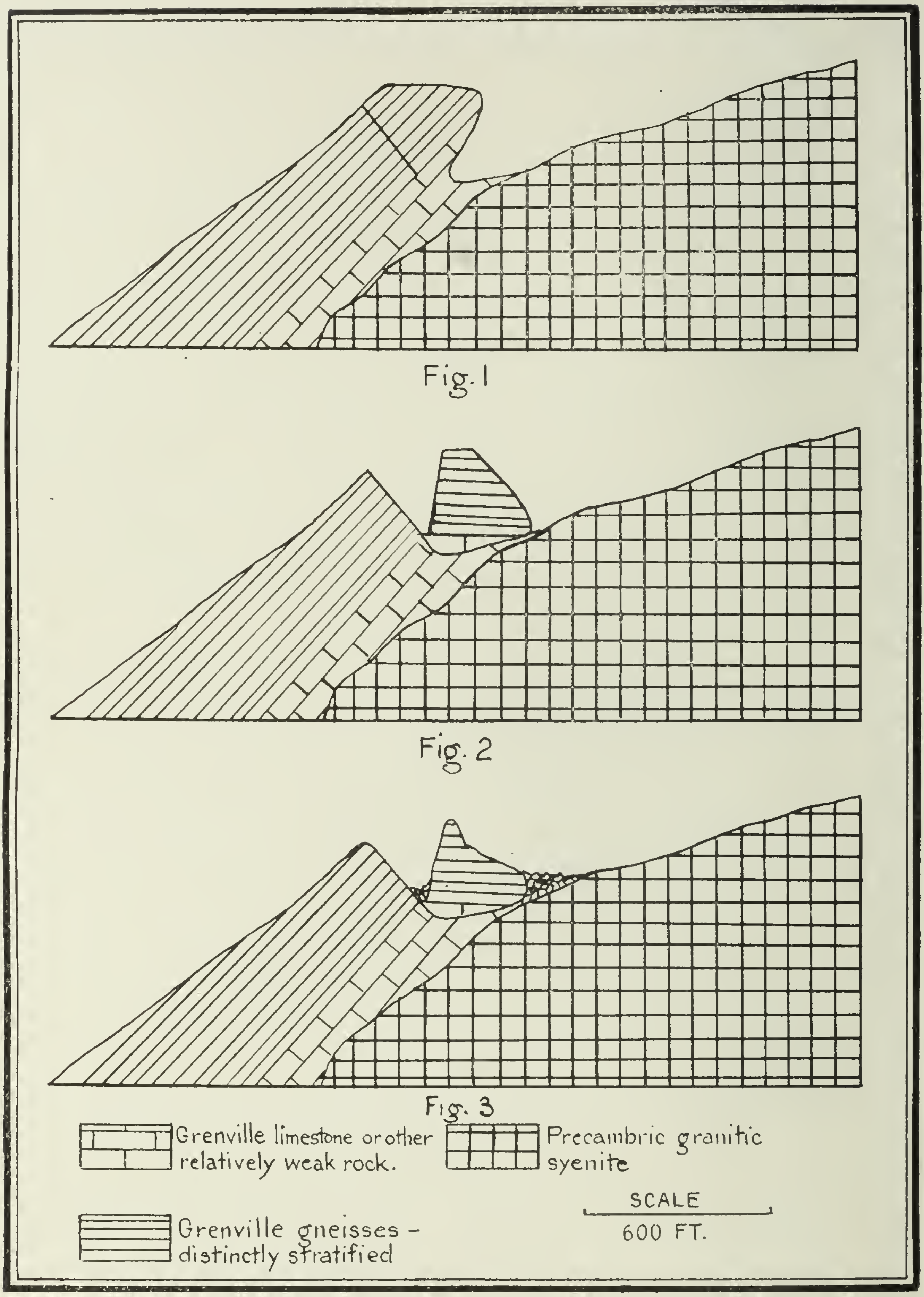
Examination of the accompanying figures will make clear the history of the development of the great rift. The lapping of the Grenville strata against the side of the hard, homogeneous syenite of the mountain mass, with the weaker beds practically in contact with the igneous rock, was decidedly favorable for undermining (figure 1) due to removal of the weaker material by erosion or solution, or both combined, by waters coming down from the higher portion of the mountain during heavy rains or melting snows. Instead of the type of undermining indicated in figure 1 there may have been removal only of certain calcareous layers or, possibly a thorough honey-combing of the underlying weaker mass thus greatly weakening the support of the overlying mass.

Finally the undermining proceeded far enough so that a great block of gneiss, already practically separated by a prominent joint-plane from the ledge of the mountain side, was suddenly pulled over by the force of gravity (probably aided by the wedge-work of ice) as shown in figure 2. This great block, from 600 to 700 feet long and from 100 to 250 feet high, swung through an angle of 60 to 70 degrees with greatest subsidence toward the north, thus readily accounting for the marked differences of strike and dip of strata on opposite sides of the rift. It is difficult to conceive how such an undermining process could have been carried far enough unless we postulate relatively weaker or more soluble rock underlying the Grenville gneisses.

That the great block fell no less than 75 to 100 years ago is proved by the fact that trees of considerable size have grown within the chasm, while the large accumulation of talus materials suggests a much longer time than 100 years. On the other hand, the rift is certainly Postglacial as indicated by the utter absence of any evidence of glaciation within it.

As a result of a moderate amount of weathering and the sliding of joint-blocks down the steep slopes, the present-day conditions were reached as shown in figure 3.

The geological principles of undermining etc. here set forth are by no means uncommon, but the development of such a great rift in this manner is somewhat unusual, and it appears to be quite unique in the Adirondack region.



East-west structure sections through the western side of Chimney mountain (looking northward)

Fig. 1 Showing essentially the condition of things not long before the development of the great rift. The position of a prominent joint plane is indicated in the Grenville gneisses.

Fig. 2 Showing essentially the condition of things immediately after the development of the great rift due to breaking away of a large block from the parent ledge of Grenville gneisses.

Fig. 3 Showing the present condition after some weathering and the accumulation of large, angular rock fragments at the bases of the steep slopes.

THE ORISKANY — PIC D'AURORE EPISODE OF THE APPALACHIAN DEVONIC

BY JOHN M. CLARKE

Theme. *In the northeastern Appalachians the Oriskany episode was represented by a heavy deposit of shoal-water sand with the same peculiar fauna that characterizes the sands of this period in the central Appalachian region. This development appears to be restricted wholly to one of the northern channels which follow close upon the line of the River St Lawrence downthrow.*

The Oriskany sedimentation in New York is now understood as the record of a transgressing shelf sea in which the obvious movement of the water was progressively west-northwest. Both in petrology and biology this movement is clear. The shallow waters bounded a continent which lay not far to the north about the interior sea of Appalachia, and were receiving a heavy landwash from subsiding shores; tides and the undertow washed the fine muds far out leaving behind in the shoal waters a clean quartz sand. In New York these sands carry what is historically the typical fauna of the formation, for it was the first to become known and is still to be regarded as the characteristic biota of the "Oriskany." This assembly was largely made up of heavy shells, both of brachiopods and gastropods, and it has been a frequently expressed conception that such ponderous shells as these were a direct response to the demand for more secure protection in the play and pounding of the waves along the strand. There is, however, a well-known and so-called "calcareous Oriskany" in southeastern New York, a region where a larger and much more variant fauna existed and where the sediments are indicative of deeper water because of the presence of lime. These deeper sediments carry a very large silica and clay content, and the condition of the silica is not that of quartz sand nor can it yet be safely regarded as the fine silicious outwash from the shore. The petrology of this silica content has yet to be fully deciphered. Its chert masses and the irregular distribution of the silica matrix indicate secondary change and quite possibly an obscure benthonic fauna not yet known. The very clear distinction between the fauna of the sands and of the limestones is recognized, and it is evident that, in these New York occurrences at least, the heavy species which locally abound in the

sands are rare in the limestones, and when they do occur are quite likely to be of smaller size. The inference from these conditions has been a natural and easy one and is to this effect: that the sand fauna represents the shoreward movement of the fauna of the period and is composed of well-adjusted representatives and survivors of the deeper water. This is a conclusion which is quite reasonably applicable to such conditions, for we must often interpret these near-shore faunas in terms of migration from the outer sea.

In actual succession the sand beds of the Oriskany are a later term than the lime beds of Hudson, Glenerie, Highland Mills, Otisville etc., but this fact does not affect the fauna as such; a readjusted element out of the more prolific deeper water reservoir.

Turning to the expression of this Devonic episode in the northeastern Appalachians, we find a better evidence for the inferences above intimated, for there it is obvious, in the first place, that there is no real "facies" relation between the sandstone fauna and its environment, and it becomes perfectly clear that the sand species of New York must be regarded as only happy readjustments which traveled into shoal waters from the deeper biota, because this association has in full exemplification all the elements of the fauna together, brachiopods and gastropods with their full weight of shell, in the lower or Oriskany horizon of the Grande Grève limestones.

The Grande Grève limestones constitute a series which is faunally comprehensive, for its upper beds carry clear indications of a later than Oriskany fauna, while its lower beds express the Oriskany element; and in its petrology it is a mass of deposits gradually increasing in purity of lime from the bottom up, while the impurity of the lower layers is not silica in the form of sand but a clay-silica matrix. In the higher beds the silica becomes much more obvious and often is segregated into horizontal chert masses, and even where the limestone appears to be pure there is often a large residuum of silica which in spots is practically composed of masses of silicious sponge spicules.

The expression of the Oriskany sedimentation episode in the Grande Grève series of northeastern Gaspé is highly typical and apparently perfectly normal. Here exist, for example, heavy Rhynchonellas, Hipparionyx, Rhipidomella, Chonetes, Spirifer, Rensselaeria and Diaphorostoma, as in the sandy Oriskany of New York, with no diminution of size or weight but in a highly calcareous matrix and in association with species which farther westward represent the earlier facies of the Oriskany in New York.

In this northern Gaspé region the shoal-water sand and the shoal-water fauna as such are apparently quite absent from the series.

I have recently had occasion to describe the Pic d'Aurore section.[1] The Pic d'Aurore is the high, transected vertical mountain face which overhangs Malbay and faces the north shore of Percé on the Gaspé front. The cliff section here is a reasonably long one, extending a distance of about 3 to 4 miles from Cape Barré at Percé to Cannes-des-Roches and thence on to Corner-of-the-Beach. The section from Cape Barré, which is at the Percé end and therefore at the east, three-fourths of the distance to Cannes-des-Roches, is composed wholly of the much contorted pre-Bonaventure rocks, and in the Pic d'Aurore, where the section reaches its maximum height, the rocks of the Lower Devonic are best exposed.

Previous descriptions have made it obvious that the Percé limestone, which constitutes the Percé rock and a part of the sea cliff of Pic d'Aurore, is, on the basis of community of species, continuous with the Grande Grève limestone, but it has not been assumed at any time that the Percé limestone was to be closely paralleled with the Oriskany division of the Grande Grève limestone. The face of the Pic d'Aurore and of the entire line of the cliff wall, known in the community as "Les Murailles," is brilliantly colored, and in the Pic d'Aurore itself much of this color, in the lower and vertical beds, is due to a washing down of color from the horizontal red Bonaventure beds, which form a cap to the summit. The inaccessibility of the cliff face, the masking of essential by secondary structures and the diffused coloration of the section easily confuse the observer so that the interpretation of the succession is not without difficulties. I bring it to notice in this connection because of its demonstration of the fact that in this part of Gaspé the shoal sedimentation of the Oriskany episode was actually highly developed. Here is a fairly close fold of the beds lying beneath the Percé limestone and the order of succession will be intelligible from the diagram facing page 152.

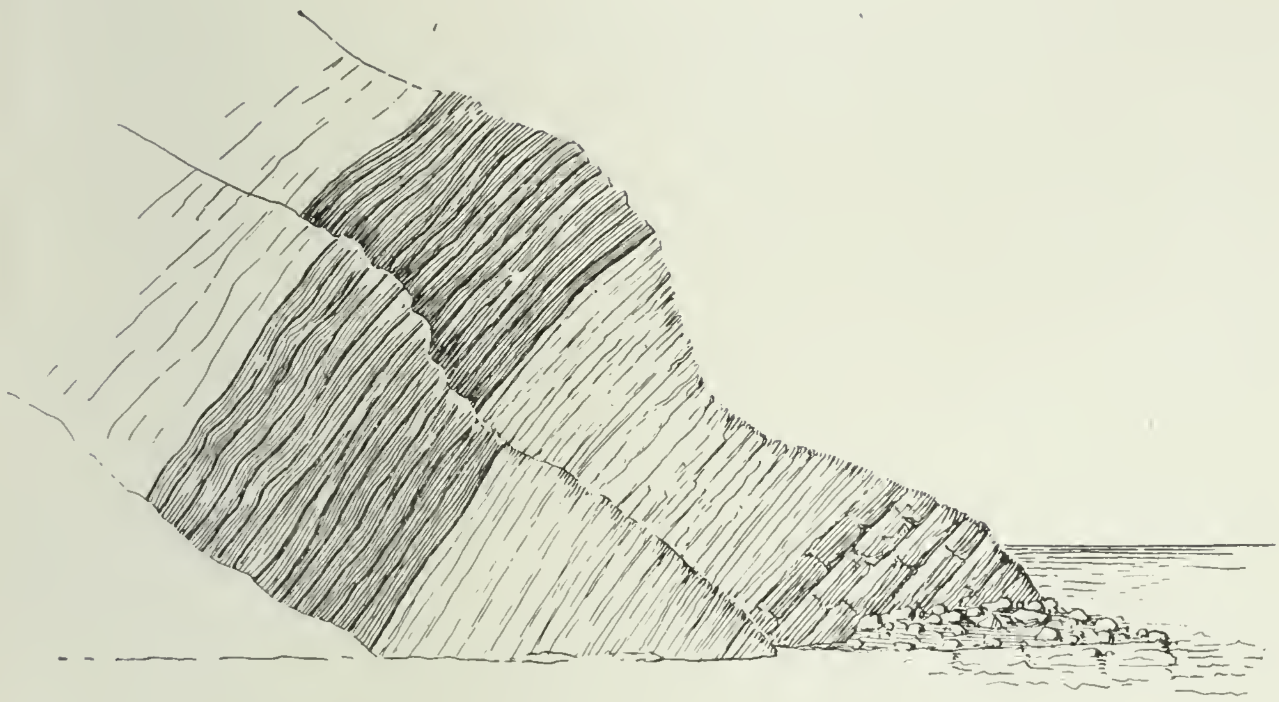
The "Percé limestones" are here underlain by rather thick series of white or greenish-gray sandstones which are essentially devoid of fossils though carrying traces of something like a Cladopora. They are for the most part thin bedded and are not of a sort to promise much in the way of fossil content, though in their lower part, on the west flank of the syncline, they have produced

[1] Geological Society of America, Philadelphia meeting 1914.

Spirifer murchisoni and Rhipidomella musculosa. In the midst of these folded sandstones, however, on the east flank of the anticline, lies a darker sandstone band in which the grains are notably coarse, in places actually pebbles, and here, in bad preservation, occurs the typical sand fauna of the New York Oriskany; that is to say, Rensselaeria ovoides, Leptaena ventricosa, Spirifer arenosus, Leptocoelia flabellites, Hipparionyx proximus, Diaphorostoma ventricosa and a large Pterinea; no other fossils have been observed and none at all that would be regarded as tying this fauna and its formation to the deeper waters or the deeper water fauna.

The Barré limestone at the eastern end of the section is known to contain the trilobite Dicranurus, and this alone is evidence of its very earliest Devonic age, and the horizon is thus, rightly I think, construed as the base of the entire Devonic section. The contact between this and the Percé limestone on this cliff section is a fault, as is very clearly shown. It is probable that the Barré limestone is a term lying beneath the limestones of the Pic d'Aurore fold, in view of the recognizable difference in petrology and the fauna. The *Pic d'Aurore series* is the term now used for this succession of predominant sand sedimentation with intermingled limestone beds, and it may be regarded as extending from the base of the Percé limestone down to the contact line between the sandstones and top of the Barré limestone.

The contact of the Devonic with the earlier beds is an unconformity at the west of this section and both Siluric and Ordovicic strata are exposed at the base of the cliff near the mouth of the couleé which runs down at this point from the face of the Grand Coupé in Percé mountain. On the other side of this couleé the cliff is composed of further development of the corrugated Siluric beds above with Ordovicic beds beneath. From this point the section on to Cannes-des-Roches or the northwest end of the cliffs is represented as composed entirely of the green and mottled marls, red sandstones and dark shales of the Bonaventure conglomerate, all of which have obviously been overturned from the Table-a-rolante and which form only a thin veneer overlying the seaward edges of the Siluric-Ordovicic beds.



The "Oriskany" band (dark lined) in the Pic-d'Aurore formation

This layer is a band of only 2 or 3 feet in thickness, and with the white sandstones above and below, the total thickness of the sand deposition is 100 feet or more. Under the sands in the heart of the anticline comes a blue-gray limestone becoming brown and dolomitic; Leptaena rhomboidalis, a large Palaeoneilo and a coarse meshed Dictyonema have been found, but the beds are specially characterized by the abundance of Haliserites, a Fucus highly characteristic of the early Devonic of western Europe but essentially absent elsewhere from the Appalachian record. Below this horizon are red-yellow platten-limestones with a large element of sand, and these are visible in the section only on the western limb of the syncline. In these beds has been found a very large Homalonotus having a body width of 3 inches, and a large Diaphorostoma. After some 40 feet of these beds follow below 75 feet more of much distorted and corrugated green-gray thin sandstones which bend upward to an almost vertical position.

The succession of this entire series shows a marked diversity on the two flanks of the folds, the true Oriskany fauna with its dark sandstone band at the east not appearing at the west, and the limestones beneath, constituting the part of the decapitated fold, are identifiable on the uprise at the west only as interbedded with the sandstones. This change is probably somewhat exaggerated in the sketch here given, but it is evident that the close folding has squeezed out these limestones in some measure, and, further, that the sandstones which make the lowest term at the west were not caught in the edges of the fold and are thus not represented on the eastern slope.

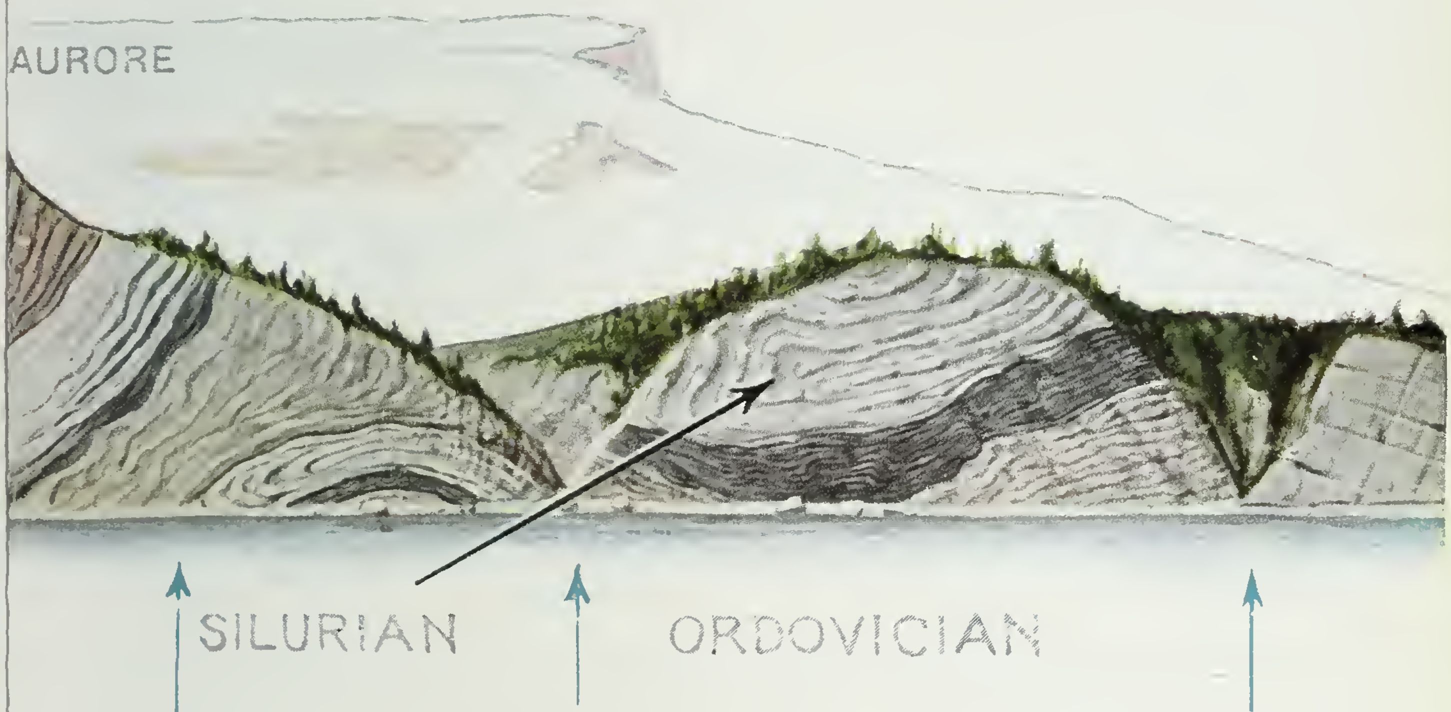
Explanation of Pic d'Aurore section. This is the cliff section extending from southeast to northwest and facing the Mal-Baie. The attempt has been made to give the strata approximately their natural coloration in the morning sun, though actually the red color of the summit peak is spread downward by the leaching of the rains over the surface of the less brilliantly tinted strata. The height of the Pic d'Aurore is about 800 feet. A part of the village in the north bay of Percé is seen beyond Barré cape. The section cuts the Appalachian folds of the Precarboniferous Paleozoic somewhat obliquely but is almost at right angles to the section on the gulf front at Percé from Cape Barré south.

The mountain in the background is the plateau or relict-mountain, the Table-à-rolante, to whose type of structure reference is made again in the following paper. This relict-mountain is composed of red Bonaventure or post-mid-Devonic-Carbonic and sands and conglomerates lying in low waves dipping toward the north, and its beds rest on the eroded folds of the Paleozoics. A moiety of these horizontal Bonaventure beds makes the summit of the Pic d'Aurore where they lie on a truncated anticline of the Devonic series.

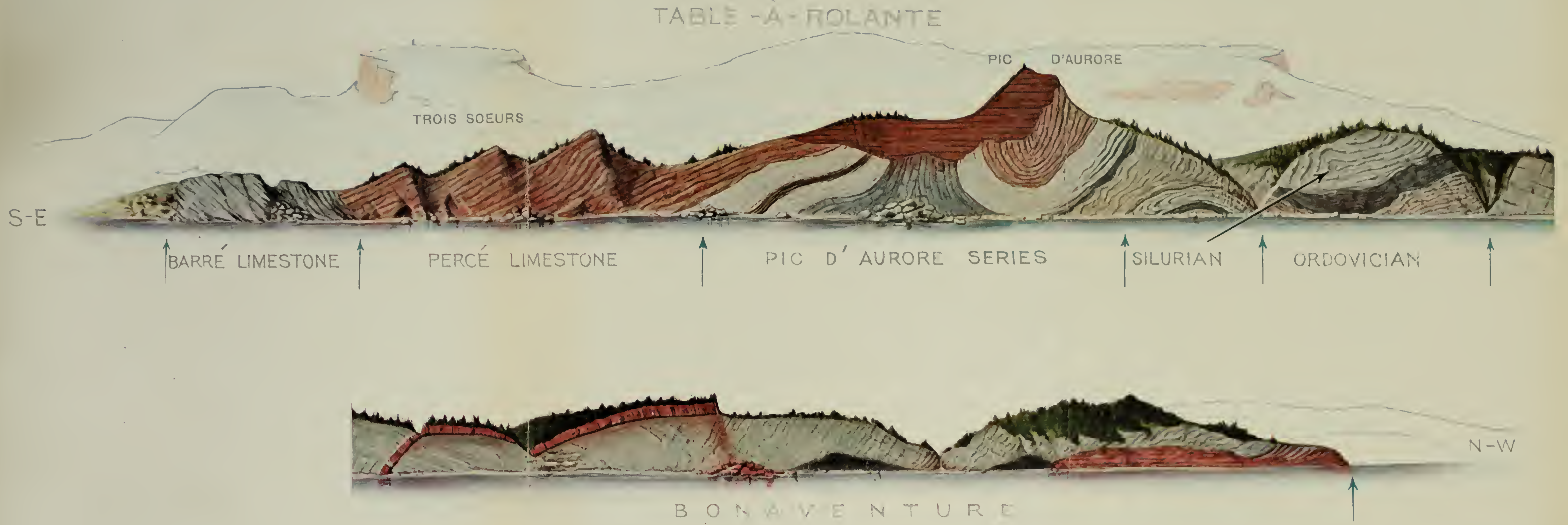
Bonaventure conglomerate. All the northwestern end of this section is constituted of this formation and the strata here slope evenly to the water so that the observer from the present point of view looks against the up-surface of one bed or of closely successive beds. This mass of the Bonaventure has obviously fallen down and over from the horizontal plateau mass above, from which it has been rifted. Sections across this mass at right angles to the shore show it to be a mere veneer leaning against the Siluric-Ordovicic beds. The angle of attitude in these Bonaventure marls and sandstones lessens toward the west, and at the end of the section at Cannes-des-Roches the beds lie again in a horizontal position. The rocks are mostly gray-green and mottled sandy marls, with some sharply outlined beds of red sandstone and conglomerate layers, and the edge of one of these, where the stratum has been broken off and slipped into the sea, is shown at the right. There are also some patchy layers of dark shale.

Next follows in order of succession downward the *Percé limestone,* which here makes the Trois Soeurs or the three cliffs at left of the Pic d'Aurore, and whose closely infolded remnant is seen at the right on the flank of the Pic.

Below is the *Pic d'Aurore series* in characteristic close folds; first, the white sandstone showing in the east flank the dark band with


AURORE
SILURIAN
ORDOVICIAN


N-W



THE PIC D'AURORE SECTION

the normal Oriskany sand fauna, merging beneath into limestone layers which seem to carry a uniform calcareous content through the heart of the fold and, thus, to lack the sandy element which follows in the west flank of the peak. This calcareous sedimentation may be regarded as indicated in the lower beds of the white sand of the west slope where a still lower term is shown in the corrugated vertical and thin-bedded sandstones. For the present the Pic d'Aurore series is constituted of the terms shown in this double fold.

The line of contact between the lower sandstone of this series and the underlying disturbed Siluric is an unconformity and probably the term represented by the Barré limestone shown at the east end of the section is here missing. The Siluric limestones are displayed in this section at the base of the west flank of the Pic and in the upper part of the next cliff face, and also along the walls of the couleé which runs from the shore here back to the mountain above.

Below these much disturbed and blue-gray limestones are gray, thin-bedded limestones, passing into a dark shale with a very characteristic Lorraine fauna.

THE RIFTED RELICT-MOUNTAIN, A TYPE OF "OLD RED" OROGENY

BY JOHN M. CLARKE

Theme. *Mountains of "Catskill" type and age have generally been regarded as plateaus or mesas downcut by rejuvenated drainage. It is probable that their isolation as mesas is due to the rifting of their sides by solution of the underlying pavement, especially where the latter is calcareous.*

The Catskill mountains of New York, an elevated and much dissected plateau of horizontal rocks, are now interpreted as a deposit made largely in the deltas of the streams which were the drainage outflow from mountains at the east whose roots alone are known to us as the hills and ridges of southern New England. This conception of the origin of the Catskills as a continental rather than a marine deposit, formed at the edge of the continent where fresh waters were pouring into the salt, is an old one which has gradually worked itself into general acceptation from data accumulated from many sources and at the hands of many investigators. The additional conception that it is the accumulation of land wash from the degradation of now wasted mountains at the east is one that we owe more explicitly to the recent work of Professor Barrell.

The geological age of the Catskill formation in the Appalachian region as a whole has been quite uniformly regarded as covering the final term of Devonic time, and there has been no conclusive evidence adduced as yet that this terrestrial sedimentation ignored the conventional marine boundaries between the Devonic and the Carbonic. The writer has at one time or another expressed the belief that, so far as the Catskills of New York are concerned, a coordination of deposits of this "Old Red" type would indicate the fact that the Devono-Carbonic marine time boundary line was actually transgressed in this deposition and that the upper part of the original Catskill sedimentation in New York, whether or not any trace of it remains from the subsequent dissection of the Catskill plateau, was deposited in post-Devonic times. This interpretation was suggested in the first place from a study of the so-called "Catskill" deposits of the southern counties of New York west of the general area of maximum Catskill sedimentation and at a time when it became necessary to subtract from what had been

regarded as "Catskill" certain areas obviously of Carbonic age and now designated as such on our geological charts. The formal subtraction of these elements has left certain restricted areas which express, how truly we do not yet know, the presence of Devonic Catskill sedimentation in that region. Study of the so-called "Bonaventure formation" in the northeastern Appalachians, of like composition, color and attitude to the Catskill, has fairly indicated continuous sedimentation through the last term of the Devonic time into the early terms of Carbonic time, and increases the probability that this type of "Old Red" sedimentation in the middle Appalachians also overpassed the Devono-Carbonic boundary line.

To students of geology and topography the attitude of the Catskills in New York has presented an unanswered question. While one may be impressed with the rapid degradation of the Catskill mountains massive and the deep downcutting of the drainage belonging to its successive peneplains, still the most conspicuous and most striking feature of this topography is the abrupt eastern face which fronts the Hudson river. Exposed as this face is throughout its entire length to the great thoroughfare of traffic up and down the Hudson valley, its origin excites constant inquiry and its explanation has never been satisfactorily set forth. While these eastern walls of the Catskills are sheer and their almost horizontal strata stand out bare and conspicuous to the observer, they are nevertheless somewhat rounded off by wear and the approaches to the heart of the mountains from the east not so abrupt as they may seem, yet to everyone who attacks them from this side their abruptness is their most impressive feature.

The question that promptly arises in the thoughtful mind, looking upon this high pile made up of the edges of horizontal strata, is this: What has become of the east and northeast continuation of these horizontal beds which, if continued at the angle at which the beds now lie, would have stretched as a mantle far over the Hudson valley and the western hills of New England?

I am not aware that the geological conditions surrounding these mountains themselves present an immediate solution to this problem, and yet I think the answer is to be found by turning to some other part of this sedimentation chapter where the mode of such mountain building is more lucidly set forth. The Catskills of New York in their eastern portion have been deposited on an area of old rocks which were folded and distorted before this later sedimentation began. Part of the pavement area on which the Catskill sedimenta-

tion rests is of the so-called "Hudson River shale" but other parts, particularly those underlying the mountains where the eastern face reaches its most abrupt expression, are the distorted limestones of the late Siluric and Upper Devonic, the limestones which enter so very largely into the composition of the features which Professor Davis has designated as the "little mountains east of the Catskills" and constitute the broad lowland between them and the Hudson river. In lower Quebec and New Brunswick the equivalent continental deposit known as the "Bonaventure" mantles the coast regions only, lies, like the Catskill, for the most part without distortion on the edges of highly disordered Siluric and Devonic limestones, and its material may have been derived from the northern and northeastern shores of the uplifted continent of Laurentia and its north Atlantic extent, for the fact of this derivation of sediment from the east is evident in the westward thinning of the mantle wherever it is found. Its greatest thickness is, like that of the Catskill, always at the east.

Behind the village of Percé, P. Q., which stands at the outermost front of the Gaspé peninsula, rises a cluster of mountains whose center is composed entirely of this sedimentation of coarse conglomerates and heavy sands. The summit level at this center lies at approximately 1200 to 1400 feet and the summit platform is a gently rolling surface which retains approximately its original form without much degradation and with very little evidence of stream dissection. The long, low rolling summit, sloping off toward the north, impressed the early French settlers and they gave to the place the name *Table-à-rolante,* a term which applied to the whole plateau of the central Percé mountains, the outer and easternmost of which, with its sheer red cliff like that of the Catskills, is today more commonly known as *Mt Ste Anne.* This mass of rocks has in itself no structural features not comparable with the Catskills of New York. They are on the whole more conglomeratic, but the approach of their strata to horizontality, their low, long undulations and their greater thickness at the east, all indicate a similar contemporaneous, if not common, origin.

The *Table-à-rolante* is an uplifted relict of this Devono-Carboniferous Bonaventure formation, bounded by four sheer sides and resting on the upturned Paleozoic limestones. On all except the seaward side these Paleozoics surround the *Table-à-rolante,* rising to greater heights and extending back into the great Paleozoic field of interior Gaspé. The *Table-à-rolante* itself stands like a tremendous cake of pack ice on the waves of the sea, an isolated, almost

quadratic mass of this continental deposit. The bounding walls are so abrupt, and so brilliant as well, as to make an extraordinary type of mountain scenery which is not comparable in its effect to anything known to the writer. To the casual observer this isolated quadratic mass with its high walls is naturally interpreted as a residual block left behind by the faulting away of its lateral parts. I think that this is probably an approximate explanation, but not a final one. The faulting has taken place in the sense that there has been a removal of the outlying portions along approximately vertical planes and probably along corresponding vertical joint faces, but the causes of this removal are, I think, not due to the thrusts generally effective in the process of faulting but to the downsinking of these lateral parts through the removal of the basal calcareous pavement by solution. This fact comes into rather clear evidence on a consideration of the outlying region. This is a part of the tremendous limestone region of Gaspé where practically all the vast Ordovicic and Siluric strata, with a thickness of probably not less than 10,000 feet, and the superjacent calcareous Devonic strata not only reach the coast but run far out to form the coastal shelf. The solution and destruction of this calcareous mass on the sea front is obvious on every hand, particularly in the ragged limestone cliffs and islands which bound the coast.

It is on this open shore, where the sea has cleared away obstructions and long ages of its activity have worked the greatest decay upon the limestone pavement, that the process of the rifting of this Bonaventure plateau becomes most apparent. The sea face of this plateau — Mt Ste Anne — is sheer and in the line of its normal, out into the sea, lie (1) the joint or rift block, called Petite Ste Anne, which has settled down close to the foot of the parent mass and from which it is today separated by a rift only a few rods wide; (2) the Robin reefs whose tops are exposed at low water some 100 rods from the shore; (3) Bonaventure island, 3 miles away, itself a great joint-block with its higher edge to the eastern sea, its lower to the mainland, its surface slope thus from east downward to the west.

It is not to be bluntly stated that this joint-block of Bonaventure island was actually rifted from the face of the residual plateau, as though first in the order of visible remnants, and slipped to its distorted position along the decaying limestone base on which it rests; it is implied that some such process has been in effect; that the Bonaventure block has actually been displaced and dislodged from its original place with just the same degree of certainty as that

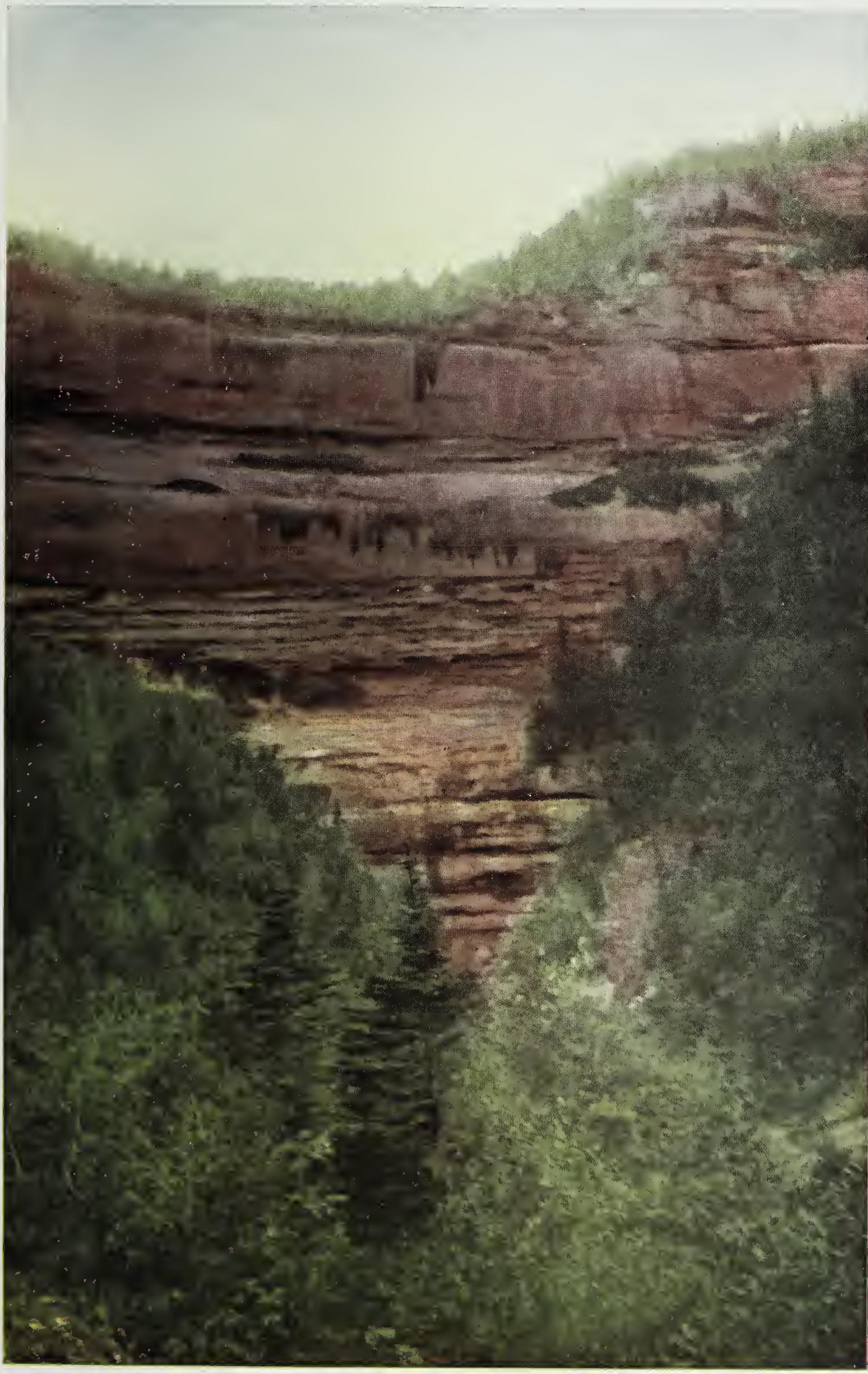


TABLE-À-ROLANTE, PERCÉ

Grande Coupe. Siluric limestones in lower foreground

(By Lillian Douglas Bostock)

Table-À-Rolante, Percé
Eastern rift-face; the Grande Coupe
(By Lillian Douglas Bostock)

Diagram of the relict-plateau mountain of Bonaventure conglomerate at Percé; from the South.

Sketch of the Percé Mountain from the North showing Ste Anne, Petite Ste Anne (rifted) and the downfallen masses of this conglomerate sheet which lie at the water edge against the distorted Paleozoics

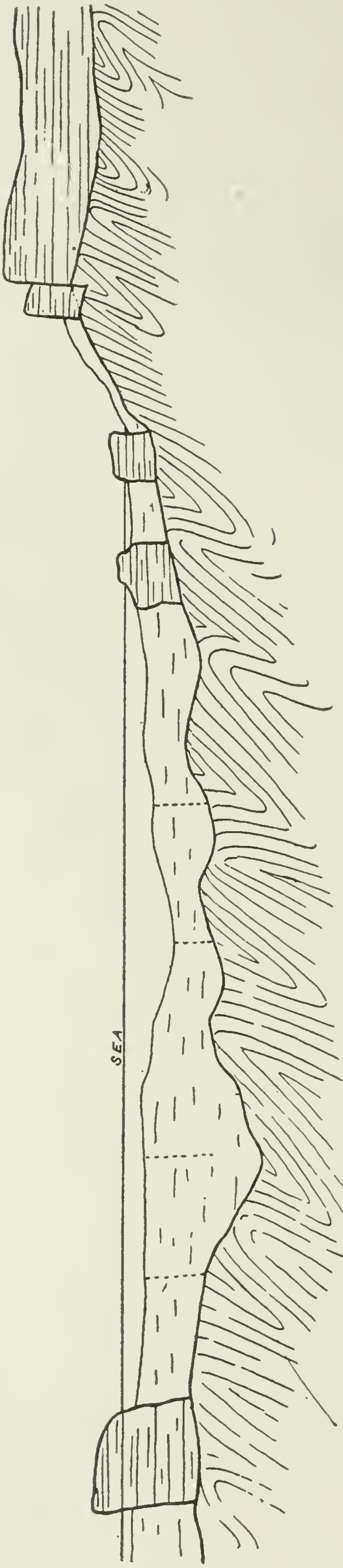


Diagram sketch showing the suggested rifting of the Bonaventure conglomerate. From the right successively Mt Ste Anne, Petite Ste Anne, Robin reefs, Bonaventure island.

it was once a part of the shoreward mantle. The rifting away of the ragged block now making the Robin reefs, from the mass of the *Table-à-rolante,* is a more proximate conclusion. Here on the sea front the remnants of these torn-off blocks are more beneath the eye than elsewhere at the sides of the *Table-à-rolante* platform, but these other sides are not without their evidences of downthrow blocks. One sees them on the north at the foot of the Grande Coupé and the shore of Malbay from Grande Coupé to Cannes-des-Roches and to Corner-of-the-Beach is an overturned mass of Bonaventure tipped down over a basement of Ordovicic-Siluric limestones.

Such rifting as this, resulting from a solution of the basement, has naturally been effective wherever Old Red deposition was left on a limestone base — and these conditions hold true for the northeastern face of the Catskills. Here the relicts of the process bear the marks of great antiquity in notable contrast to those in the northeast. The scarp surfaces of the Catskills are rounded, sloped and deeply eroded, in the Percé mountains they are sharp and fresh; but there is throughout the mountains of Gaspé and their relations to the sea an aspect of newness which constantly surprises the observer. That, however, the rifted Old Red mountains of the

far northeast and of the eastern slopes of the Catskills have been constructed on the same principle and are due to like causes, there seems every reason to believe.

SOME FUNDAMENTAL TYPES OF HYDROSPIRES WITH NOTES ON POROCRINUS SMITHI GRANT

BY GEORGE H. HUDSON

In many of the limestone beds of Valcour island, deposited under lagoon conditions on the lee side of reefs and containing much fine, silicious or argillaceous material derived from land wash or atmosphere, we find an abundance of echinoderm plates so well preserved as to show minute details of form and structure. This material is so abundant and so varied in nature as to throw much light on the paleobiology of the group in question and the value of this material is enhanced by the fact that it represents a time so near the beginning of available life records. It is the purpose of this paper to point out four fundamental types of hydrospires, three of which are shown in the Valcour island material. As one of these types is identical with that presented by Porocrinus, and as this peculiar type seems to be little known, we shall here use Porocrinus smithi to exemplify it.

In plate 1 we present two hydrospire areas enlarged to 10 diameters and photographed without gum mounting, as this gives us the more brilliant surface detail. In plate 2 we show a single hydrospire area under gum and enlarged to 20 diameters. Billings in Canadian Organic Remains, Decade IV, page 34, called these exposed hydrospire areas "pectinated rhombs," but the ontogeny and position of the folds will show that they differ fundamentally from a true pectinirhomb. In the latter the hydrospire is confined to the margin of *two* plates, the folds are perpendicular to these margins, the *youngest* folds lie nearest the plate corners and these corners are left fairly strong with plate stereom and so fitted to prevent undue pressure on the sutural ends of the hydrospire folds. Hydrospires of this type occur in the Caryocrinidae and Callocystidae. They are variously protected, being sometimes covered at the suture as in Callocystis or more completely covered as in Caryocrinus. In Porocrinus each hydrospire is situated at the junction of *three* plate corners, the folds meet the sutures at an acute angle (for they are parallel with radii running to plate corners), the oldest folds lie nearest these corners and pressure on their elongated and therefore weakened walls is prevented by a heavy epithecal bar of stereom which crosses and strengthens the middle portion of

each suture. To apply the term rhomb to the triangular hydrospire so formed is somewhat of a misnomer but the more serious error lies in using the same term for types of structures so different in their ontogeny.

In "Paleozoic Fossils," volume II, part I, page 96, Billings proposed the term hydrospires for all specialized respiratory areas in echinoderms and on page 99 made the term include even the epithecal respiratory areas of Paleocystis, for he called these "external hydrospires.[1]" It would be conducive of clear thinking, however, if we could limit the use of the term "hydrospires" to specialized folds of the outer body wall which became subthecal in position, for if we may speak of the epithecal papulae of Palaeocystis or of Palaeocrinus as "hydrospires" we might with equal propriety use the same term for the papulae of asteroids.

Restricting then the term hydrospires as suggested we still need special names for special forms, as witness the term "multidisjunct pectinirhombs," but such terms should be coined to express true ontogenic differences rather than to denote an external similarity in appearance due to convergence in development. For example, the "triangular pectinirhombs" of Porocrinus might be called *goni-hydrospires,* but as in all types of echinoderm respiration water is the medium through which oxygen is received, we might shorten the term, without loss, to *goniospires.* This name would be appropriate not only because of the position of these hydrospires at plate corners, but also because the folds themselves are bent abruptly through an angle of about 60 degrees as they cross the sutures. Hydrospires of the Glyptocystis or Pleurocystis type, from their position on plate sides or margins, could be called *craspedospires.* These two types are alike in that their function is purely respiratory and their position between regular thecal plates.

The hydrospires of Blastoidocrinus and the Eublastoidea are of a very different type, for these are "between thecal plates associated with food grooves" (see N. Y. State Museum bulletin 149, page 198) and they perform the additional function of draining away the surplus water drawn in through the process of food getting. These are *flowing hydrospires,* and the water is changed in them not simply by means of ciliary motion in their external folds,

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[1] This pioneer work of Billings I had not seen before the publication of my 1911 paper dealing particularly with respiration in the genera Blastoidocrinus, Palaeocrinus and Palaeocystis: "Studies of Some Early Siluric Pelmatozoa" in N. Y. State Museum Bulletin 149.

but it is forced through them as a strongly flowing current having a fixed direction and due to the ciliary activity of the brachioles. These flowing hydrospires probably function in reproduction and in Blastoidocrinus they carry away all egesta from the alimentary canal. In Asteroblastus (probably) and in the Eublastoidea, this flow is upward (orad) and parallel with two of the deltoid margins. This type may be known as *anaspires*. In the Parablastoidea (N. Y. State Museum Bulletin 107, page 119) the hydrospire structure is of a fundamentally different character and the flow is downwards (aborad) and across the large interradial plate commonly called the deltoid, but probably not a true deltoid in its origin. This distinct type as shown in Blastoidocrinus may be known as *cataspires*.

The term pectinirhomb might still be used for all *epithecal* rhombs, due to forking and partial covering of papulae as in Palaeocystis and Palaeocrinus, but in no case should it be used to denote any form of true hydrospires as here limited. The term pore-rhomb could also be used if applied strictly to covered craspedospires of the Caryocrinus type.

The author has suggested the new terms in the belief that their use will help rather than hinder the development of paleobiology. They emphasize some very marked differences in the ontogeny of respiratory structures and of themselves arouse a suspicion that neither the Protoblastoidea nor the Rhombifera of Lancaster's "A Treatise on Zoology," part 3, are natural orders. In the latter group, for instance, we find forms with epispires of the Palaeocystis and Palaeocrinus type together with forms having the fundamentally different *endospires* of the Glyptocystis type, and this largely because normal extension of the respiratory tracts led both to occupy rhombic areas.

In suggesting this terminology the writer has not been so radical as he would like to be. There seems to be no valid reason why the path of young students should not be made easier by using a name like the Greek *pneumon* for a final term and let our compounds express not only some characteristic of structure or position but the function as well. We already use common terms for alimentary structures although dealing with different phyla of the animal kingdom. Why obscure or banish the thought of function by the use of such terms as pore-rhombs or pectinirhombs? A portion of the table given in New York State Museum Bulletin 149, page 198, is here given to show proper place of terms proposed.

Invagination of body wall (Endospires)	between regular thecal plates (Simple hydrospires)	at corners Goniospires
		at plate margins Craspedospires
		Subtypes variously protected.
	between thecal plates associated with food grooves (Flowing hydrospires)	flowing orad Anaspires
		flowing aborad Cataspires
Evagination of body wall (Exospires)	Papulae	forking and epithecal " Pectinirhombs " or epispires.
		simple as in Cliocrinus.
	Podia	

None of the more complex types of this chart exist today, while simple exospires in the form of papulae are abundant. The forms with endospires developed in regions of remarkably clear waters, that is, waters free from lutaceous material derived from land surfaces or from volcanic ash. The simple hydrospires no doubt possessed ciliated fold-surfaces, but while simple reef muds (Hydrocalcilutites) could be easily removed from their folds by solution, any marked amounts of silicious sediments in the water would be likely to obstruct such folds and kill the organisms possessing them. Paths of melting icebergs and areas off river mouths would be likely to interfere with distribution. Changing conditions, such as the presence of a glacial period, would then lead to extinction of species over large areas. Among endospires, the flowing type was the most successful and anaspires persisted until Permian times. Forms retaining the simple or unspecialized types of exospires best survived the trials besetting them in past ages and gradually became the dominant types of today.

Plate 1

P o r o c r i n u s s m i t h i Grant

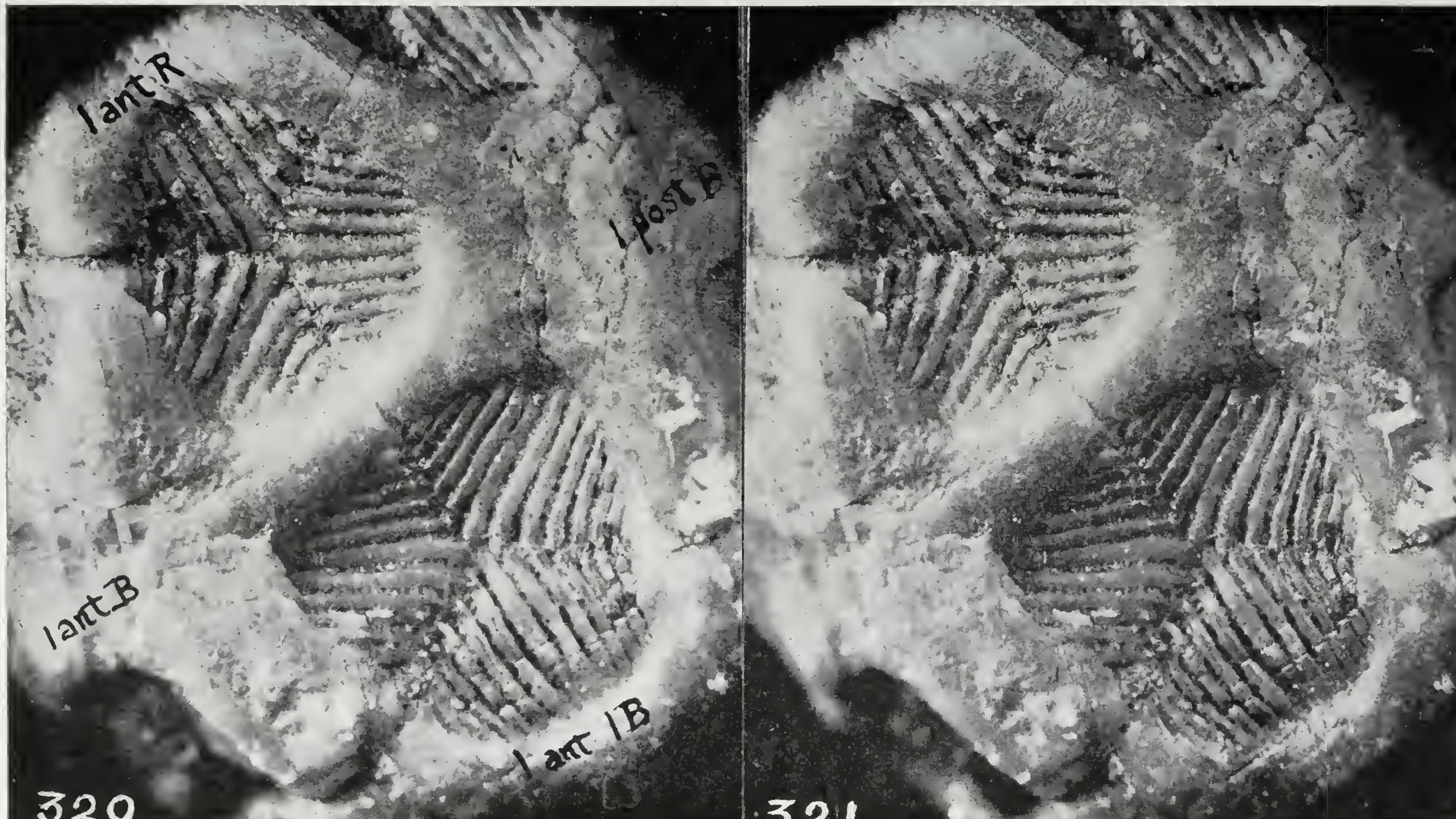
Ottawa Naturalist, vol. 1, trans. 2, p. 42, pl. 3, figs. 1–8, 1881

Chazy limestone, Ottawa Can. Victoria Memorial Museum No. 1422c.

Detail of cotype c x 10 dia., without gum mounting

The white spots on l post. B are the remains of the museum number which treatment with gumdamar and benzol had partly removed. Note the rounded or cylindrically convex outer surfaces of the hydrospire folds save on the injured portions of the folds of the 1B.

Plate I



To be viewed through a stereoscope

Plate 2

Porocrinus smithi Grant

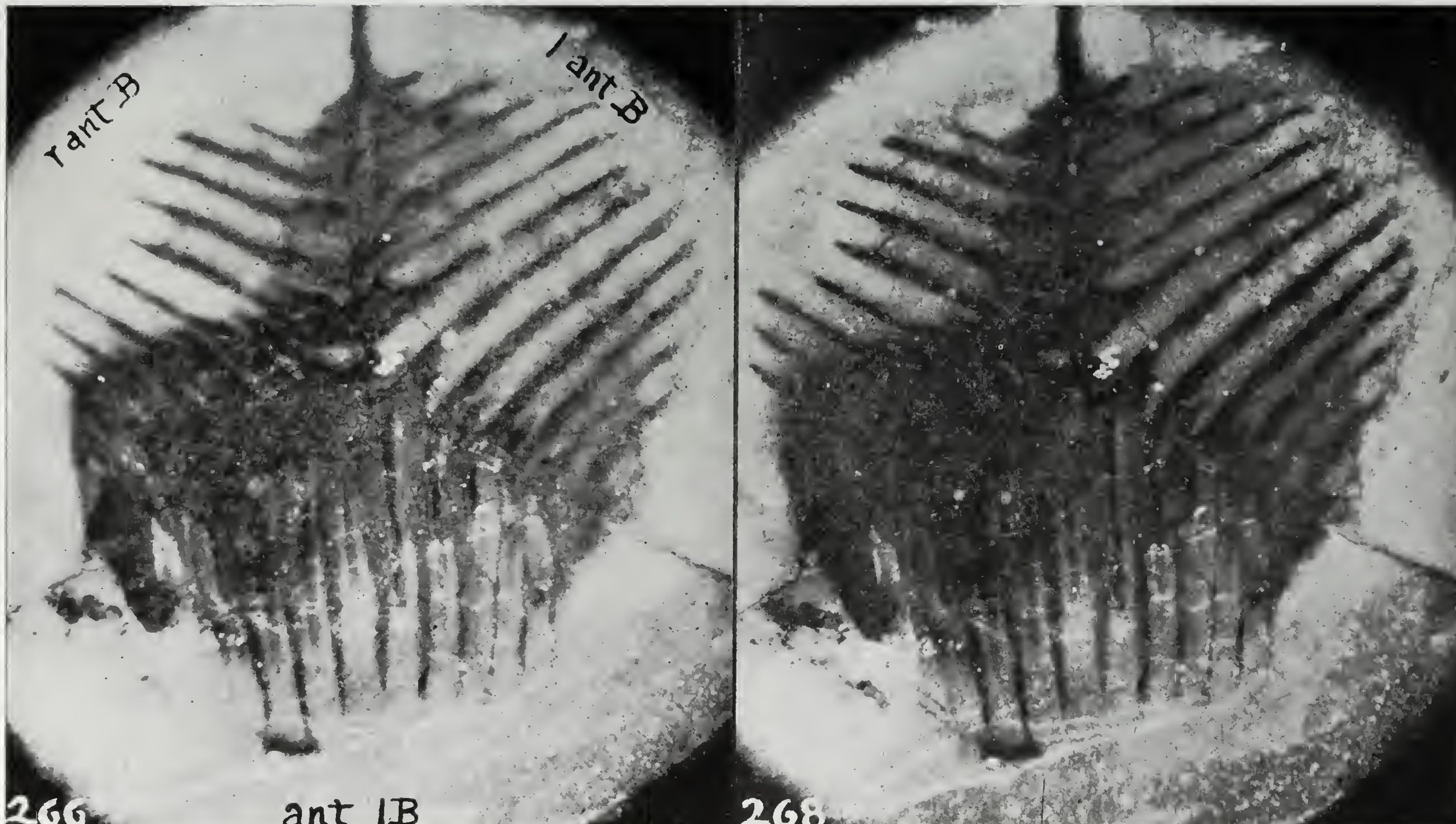
Detail of cotype c x 20 dia., with gum mounting

The *surface* here is not so brilliantly reproduced but the *penetration of light*, due to the gum mounting, is very manifest.

In the hydrospire area here exposed it will be seen that the externally open spaces between the folds (those open to sea water) have been subsequently filled with sediment from the outside, while the broken outer edges of many of these folds reveal the internally open spaces (those formerly occupied by coelomic fluid) as narrow chambers free from sediment.

In the development of goniospires the first invaginated sacs on each suture were made very close to the plate corners and the secondary sacs were formed just *outside* the area occupied by the three primary sacs and not *inside* this area as in the development of craspedospires. This changed position of formation of the secondary and subsequently formed invaginations determined the direction of elongation of these sacs during plate growth and also the form and position of this type of hydrospires. During growth the plate was strengthened by the spreading and thickening of the epistereom over the plate center and along the bar crossing the middle of each suture. This spreading epistereom formed and maintained linear series of small pores, about 0.1 mm in diameter, lying over and communicating with the external chambers in the covered and older portions of the hydrospires. These pores show beautifully in cotype "1422a," when mounted under gum.

Plate 2



To be viewed through a stereoscope

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Appendix 1

Economic geology

Museum Bulletin 178

178 Mining and Quarry Industry of New York State 1914

University of the State of New York Bulletin

Entered as second-class matter August 2, 1913, at the Post Office at Albany, N. Y., under the act of August 24, 1912

Published fortnightly

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New York State Museum

John M. Clarke, Director

Museum Bulletin 178

THE MINING AND QUARRY INDUSTRY OF NEW YORK STATE

REPORT OF OPERATIONS AND PRODUCTION DURING 1914

BY

D. H. NEWLAND

The University of the State of New York

Science Department, June 28, 1915

Dr John H. Finley

President of the University

Sir:

I beg to communicate to you herewith the manuscript of the *Mining and Quarry Industry of New York State: Report of Operations and Production During 1914,* prepared by David H. Newland, Assistant State Geologist, and to recommend its publication as a bulletin of the State Museum.

Very respectfully

John M. Clarke

Director

THE UNIVERSITY OF THE STATE OF NEW YORK

OFFICE OF THE PRESIDENT

Approved for publication this 29th day of June 1915

John H. Finley

President of the University

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Museum Bulletin 178

THE MINING AND QUARRY INDUSTRY OF NEW YORK STATE

REPORT OF OPERATIONS AND PRODUCTION DURING 1914

BY

D. H. NEWLAND

INTRODUCTION

The mineral industries experienced a decided setback last year, reversing the course they followed in the preceding twelve months which was a period of great activity. The output was smaller by nearly 15 per cent than in 1913 and during the last half of the year some branches were almost at a standstill owing to the very unsettled market and financial conditions. A number of enterprises suspended operations for a time; a few are reported to have withdrawn from business with no immediate prospect that work will be resumed. It is certain that the ground lost can not be recovered for some time and it is not unlikely that further reductions in the output of many products will be noted for the current season.

The total value of the ores and mineral materials, in the crude or first prepared forms, as reported by the individual enterprises,

was $35,870,004, as compared with $41,598,399 in 1913. The decline of activity during the year was really greater than indicated by this loss in value of the output, since the reaction did not assume serious proportions before the late summer and then developed rapidly to the close of the season. The situation at the end of the year was extremely unsatisfactory to the producers.

As a further index of the industrial conditions, a compilation of the tonnage of ores and minerals raised from underground workings has been made. The materials which are produced in New York wholly or mainly by mining operations in the strict sense comprise iron ores, pyrite, rock salt, gypsum, graphite and talc; the others are obtained by open-cast methods. The total quantity of such materials raised in the year was 2,587,710 tons against 3,156,643 tons in 1913 and 2,722,648 tons in 1912.

The products on which the valuations above mentioned are based number over thirty and with few exceptions represent the materials as they come from the mines and quarries without elaboration or manufacture, except so much as is necessary to put them in marketable form. They do not include secondary products like iron and steel, sulphuric acid, aluminum, carborundum, calcium carbide, artificial graphite, alkali products, etc., the manufacture of which constitutes a large industry by itself with an annual output of a much greater value than that returned by the industries covered in this report.

Iron ore is the most valuable metallic mineral found in the State and has been mined actively for 150 years. The gross output of the ore last year was 1,122,221 long tons. After deduction for shrinkage in concentration, which is practised by the Adirondack mines, there remained a total of 751,716 long tons of shipping product which had a value of $2,356,517, as compared with 1,217,899 long tons valued at $3,870,841 for the year 1913. This branch of mining is subject to rapid changes and the decrease does not reflect any serious complications in the industry itself. There are indications in fact that the output will soon exceed all previous records.

The clay-working industries take first rank in value of the annual production and last year returned a total of $9,475,219 which represented a reduction of one-fifth as compared with the sum of $12,077,872 reported in 1913. There was a large decrease in the structural materials like brick, fireproofing and terra cotta for which the demand was exceedingly poor; the potteries also reported

a smaller output, as did the makers of tile and sewer pipe. Practically the only branch that showed a gain during the year was the paving brick industry which registered an increase of 15 per cent, continuing the steady growth of the previous years.

In view of the depression that prevailed in the building trades the large increase in cement manufacture is remarkable, probably not paralleled by the industry of any other eastern state. The output of portland cement was 5,667,728 barrels, with a value at the works of $5,088,677, a record total. Natural cement showed a small increase, the output amounting to 232,076 barrels worth $115,117.

The stone products, including granite, limestone, marble, sandstone and trap, were valued at $5,741,197, against $6,763,054. All kinds showed a decrease, except granite which made a slight gain. More than one-half of the value was represented by crushed stone used in concrete and road construction. There was a notable falling off in the number of quarries under operation, and scarcely any new developments were reported.

The salt mines and evaporating works contributed a product of 10,389,072 barrels, as compared with 10,819,521 barrels in 1913. With this exception, the industry has had an almost uninterrupted record of growth in the last decade. The value of the product was but little below that of 1913, the actual figures being $2,835,706 against $2,856,664 in the latter year.

In the gypsum industry there was no notable change, although the output fell off slightly and amounted to 513,094 tons, against 532,884 tons in the preceding year. Most of the rock was converted at the mines into stucco and wall plasters; the remainder, about one-third, was sold crude to cement plants or ground for agricultural plaster. The value of the different products was $1,247,404 as compared with $1,306,143 in 1913.

The flow of natural gas in the different districts of the State amounted to 8,714,681,000 cubic feet, about 4 per cent less than in the preceding year, but the value which was reported as $2,570,165 showed a slight gain owing to the higher prices at which the product was sold. There were no discoveries of importance to counterbalance the normal decline of the developed territory. The oil wells in Cattaraugus and Allegany counties contributed an output of 933,511 barrels, or about the same quantity as in 1913. Owing to the decline of prices from the high mark of $2.50 a barrel which they reached in the latter year, the value of the product was considerably smaller, the total being $1,773,671.

Among the other branches of the mineral industry that shared in the activities were those of talc, graphite, garnet, pyrite, slate, mineral paints, mineral waters, emery, feldspar, quartz, molding and building sand, sand-lime brick, marl and apatite. Talc ranks as one of the more important of these, the output amounting to 74,075 short tons valued at $671,286. The mines are in the western Adirondack region. Garnet for abrasive uses is produced in the eastern Adirondacks, the product last year amounting to 4026 short tons, with a value of $134,940.

Mineral production of New York in 1913

PRODUCT	UNIT OF MEASUREMENT	QUANTITY	VALUE
Portland cement	Barrels	5 146 782	$4 873 807
Natural cement	Barrels	193 975	95 565
Building brick	Thousands	1 099 861	6 038 658
Pottery	....	....	3 367 187
Other clay products	....	....	2 672 027
Crude clay	Short tons	6 291	17 411
Emery	Short tons	611	7 332
Feldspar and quartz	Short tons	25 680	113 765
Garnet	Short tons	4 665	145 445
Graphite	Pounds	2 250 000	112 500
Gypsum	Short tons	532 884	1 306 143
Iron ore	Long tons	1 217 899	3 870 841
Millstones	....	....	13 130
Metallic paint	Short tons	7 950	78 200
Slate pigment	Short tons	2 200	15 026
Mineral waters	Gallons	9 448 348	806 298
Natural gas	1000 cubic feet	9 155 429	2 549 227
Petroleum	Barrels	916 873	2 255 508
Pyrite	Long tons	54 903	242 065
Salt	Barrels	10 819 521	2 856 664
Sand and gravel	....	....	2 584 266
Sand-lime brick	Thousands	22 225	143 345
Roofing slate	Squares	6 109	53 074
Slate manufactures	....	....	Nil
Granite	....	....	335 642
Limestone	....	....	3 852 678
Marble	....	....	252 292
Sandstone	....	....	1 321 272
Trap	....	....	1 001 170
Talc	Short tons	63 000	551 250
Other materials[1]	....	....	66 611
Total value	....	....	$41 598 399

[1] Includes apatite, diatomaceous earth, marl and mica.

Mineral production of New York in 1914

PRODUCT	UNIT OF MEASUREMENT	QUANTITY	VALUE
Portland cement	Barrels	5 667 728	$5 088 677
Natural cement	Barrels	232 076	115 117
Building brick	Thousands	943 241	4 703 295
Pottery			2 405 676
Other clay products			2 366 248
Crude clay	Short tons	7 109	12 424
Emery	Short tons	763	9 105
Feldspar and quartz	Short tons	23 751	117 390
Garnet	Short tons	4 026	134 940
Graphite	Pounds	2 483 339	151 143
Gypsum	Short tons	513 094	1 247 404
Iron ore	Long tons	751 716	2 356 517
Millstones			12 410
Metallic paint	Short tons	7 321	88 720
Slate pigment	Short tons	1 182	9 620
Mineral waters	Gallons	8 480 669	769 932
Natural gas	1000 cubic feet	8 714 681	2 570 165
Petroleum	Barrels	933 511	1 773 671
Pyrite	Long tons	61 513	266 930
Salt	Barrels	10,389 072	2 835 706
Sand and gravel			2 212 087
Sand-lime brick	Thousands	17 696	111 326
Roofing slate	Squares	4 998	40 650
Granite			367 242
Limestone			3 316 063
Marble			230 242
Sandstone			1 056 990
Trap			770 600
Talc	Short tons	74 075	671 286
Other materials[1]			58 428
Total value			$35 870 004

[1] Includes apatite and marl.

ASBESTOS

The minerals which supply the asbestos of commerce are known to occur in several places within the State, more especially in the crystalline areas of the Adirondacks and southeastern New York. They are nowhere mined at present, but the occurrences have been at different times the object of inquiry and more or less attention which in one instance has extended to considerable exploratory work. The purpose of this article is to mention the different localities which have come to light and to give whatever information is available concerning their features and possible importance.

That the local occurrences have aroused some interest from a commercial standpoint is not surprising in view of the recent great development in the uses of asbestos and of the remarkable growth

of the Canadian mining industry which supplies the larger share of the world's needs of the material. The principal mines of Canada are situated in the province of Quebec, on the south side of the St Lawrence river, not very remote from the northern boundary of New York. The district in fact extends southward across the Vermont line, in which state there are similar occurrences which have more or less importance.

The proximity of the Adirondack crystalline region to that district might be regarded as favorable to its carrying the same kind of deposits, but there is really no basis for such inference as a little consideration will show. The asbestos of Canada and Vermont is found within a belt of metamorphosed Paleozoic formations which lie along the flanks of the Green Mountain uplift. The particular home of the mineral is in serpentine, in this case the product of alteration of old igneous rocks originally composed of minerals of the olivine and pyroxene groups. A large number of serpentine bodies are known in the stretch from southern Vermont into and across the eastern townships of Quebec, but in only a few is asbestos present in workable proportions. The mines or quarries are based on masses of serpentine that carry closely crowded veinlets of chrysotile, the latter occurring in such profusion as to permit the excavation of the whole mass, from which the fiber is then obtained by hand picking or by milling operations.

No similar bodies of serpentine are found in the Adirondacks. The latest igneous intrusions in that region took place before the opening of the Cambric period, and the sedimentary formations were laid down at a much earlier date. The igneous intrusions did not include any rocks of the peridotite class (composed of olivine) and consequently there has been no material from which large serpentine masses could develop. The occurrence of serpentine and of chrysotile is limited to the crystalline limestones which are found in belts and in which the serpentine is disseminated in nodules, bands and small particles in the midst of the carbonate minerals. The proportion of serpentine to the whole rock is variable; in some places it may constitute the greater part but usually it plays a subordinate role, being one of several impurities of the limestones. It is a secondary product, formed in most cases by the alteration of a pyroxene mineral. The asbestos is a variety of the serpentine that occurs in small veins, rounded aggregates and irregular patches. It is apt to be very irregular in its occurrence, but is sometimes rather abundant within limited areas of

the limestones. The fiber looks like the commercial fiber of Canada and Vermont but seems to be of lighter color and greater transparency. From the features of its development it is regarded as a vein mineral, deposited in cracks and cavities, by solutions circulating through the limestones and probably derived from the disseminated serpentine which, as stated, is an alteration of pyroxene.

Serpentinous limestones are not at all rare in the Adirondacks; in fact they are rather common in the eastern part in Essex and Warren counties and also in the northwest in St Lawrence county. They are associated with the normal crystalline limestones, of which they are only a special development, the serpentine itself having no geological significance. In some places the rock has been quarried as an ornamental stone, since the greenish serpentine particles with the white or bluish dolomite base give a very pleasing effect that makes the stone suitable for interior decorative work. Some of the better known localities for these serpentinous marbles are just north of Port Henry on Lake Champlain, in western Moriah township, near Minerva and Olmstedville, all in Essex county, and in the town of Thurman, Warren county.

Wherever the serpentinous limestones are found asbestos may be expected in greater or lesser amount, though of course as a subordinate constituent.

The principal occurrence of this nature that has thus far been uncovered is in the town of Thurman, about 7 miles west of Thurman station on the Adirondack branch of the Delaware & Hudson Railroad. There is a large area of crystalline limestone which here and there contains bands charged with serpentine occurring as rounded and irregular patches of some size but irregularly distributed and as small grains that are more evenly scattered through the mass. Such a band was prospected a few years ago, resulting in the production of a small quantity of chrysotile or serpentine asbestos. The latter occurs principally within a small but rather persistent zone of the limestone that takes a northeasterly course parallel to the general structural trend. Within this zone occur numerous veinlets that carry a very light, silky asbestos of a maximum length of about an inch, most of which is apparently of good quality. The veins are not persistent, but thin quickly and merge into the massive serpentine of the country rock. Outside the main zone, bunches of serpentine are to be seen which are shot through with fiber, or show the presence of whitish asbestiform material. The general average of the fiber is probably not more than one-

fourth of an inch. Samples were shipped by the owner of the property to asbestos manufacturers who reported favorably upon its quality. Although a part of the rock, no doubt, is of workable grade, not a very large quantity of that kind has as yet been exposed in the workings.

A small prospect showing serpentine asbestos of fairly long fiber was seen by the writer some years ago on the north side of Brant lake, in the town of Horicon, Warren county. It is not known by whom the property was explored, but apparently the results did not warrant a continuance of the work.

Serpentinous limestones are also found in the Highlands region in Putnam and Orange counties; from the locality in Philipstown east of Cold Spring many samples of chrysolite have been gathered for museums. Mather in the New York Geological Reports for 1839 mentions an occurrence at Cotton rock in the same town on the bank of the Hudson, 3½ miles below West Point.

On Staten Island and near the village of Rye, Westchester county, are bosses of serpentine which furnish the closest parallels to the Canadian and Vermont occurrences. The Staten Island boss has a surface of about 15 square miles and constitutes the central elevated part of the island. The rock is apparently an igneous derivative, as unaltered remnants of olivine and pyroxene have been discovered in it. Both amphibole and serpentine asbestos occur within the area, the former variety being restricted to the border where the serpentine is in contact with schistose rocks belonging to the Manhattan formation. Examples of amphibole asbestos have been collected from Pavilion hill near Tompkinsville and at Fort George; one specimen found by the writer near the latter place possessed fibers nearly a foot long. Chrysotile is less common, but a few years ago was still to be found on Pavilion hill.

CEMENT

The cement manufacturers had a rather poor season in 1914. The year opened auspiciously, with the demand large enough to keep the mills operating at full capacity and prices on the same basis as in the preceding year, which was regarded as reasonable from the standpoint of both consumer and manufacturer. These conditions, however, did not hold out, as the demand began to slacken before many months had elapsed and showed a declining tendency throughout the latter half of the year. In the last four months the market broke badly under the load of accumulated

stocks which were sold at considerable concessions from the price basis that had obtained during the early part of the year. At the close it appeared that the industry would soon lose all the ground it had been able to gain during the period of relative prosperity which followed four or five years of almost unrelieved depression for the local plants.

The mills for the most part operated throughout the year at their average capacity, so that the market conditions were not reflected in the production returns, although a reduction may be looked for during the current season unless the market shows great improvement. There was a large surplus of cement carried over into the new year.

In the first part of 1914 the general average of portland cement prices was the same as obtained during the preceding year, that is, around 95 cents for standard brands. This quotation was for deliveries at the mill, not including cost of package. The New York City basis was $1.18 in bulk and $1.58 in package. The mills within the State received somewhat better prices in the local markets. Before the close of the year cement was selling in New York City at 20 and 25 cents below these quotations with large offerings. The average price received by the mills for the whole year was about 90 cents a barrel as compared with 95 cents in 1913 and 78 cents in 1912.

Conditions in the natural cement trade were practically unchanged, the present industry contributing only a small part of the total output, although a few years ago it was the principal branch.

The reports, which have been received from all the cement manufacturers within the State, show that the total output last year amounted to 5,899,804 barrels. In the preceding year the combined production of portland and natural cement was 5,340,757 barrels and in 1912 it was 4,783,535 barrels. The steady growth of the portland cement industry in the last few years has raised the production now to a higher rate than prevailed at the time of the highest prosperity of the natural cement trade.

The output of portland cement for 1914 was 5,667,728 barrels. In the preceding year it amounted to 5,146,782 barrels, showing a gain of about 10 per cent for this branch of the industry. The value of the production based on the average selling prices for the year was $5,088,677, or at the rate of approximately 90 cents a barrel. There were eight mills in operation, the same number as in 1913.

The natural cement mills contributed an output of 232,076 barrels, against 193,975 barrels in 1913. The value of the product was $115,117 or about 50 cents a barrel at the mill. Most of this cement was made in the Rosendale district of Ulster county by a single manufacturer, but small amounts were contributed by three plants in Onondaga county.

Production of cement in New York

YEAR	PORTLAND CEMENT		NATURAL CEMENT	
	Barrels	Value	Barrels	Value
1895	59 320	$278 810	3 939 727	$2 285 094
1896	260 787	443 175	4 181 918	2 423 891
1897	394 398	690 179	4 259 186	2 123 771
1898	554 358	970 126	4 157 917	2 065 658
1899	472 386	708 579	4 689 167	2 813 500
1900	465 832	582 290	3 409 085	2 045 451
1901	617 228	617 228	2 234 131	1 117 066
1902	1 156 807	1 521 553	3 577 340	2 135 036
1903	1 602 946	2 031 310	2 417 137	1 510 529
1904	1 377 302	1 245 778	1 881 630	1 207 883
1905	2 117 822	2 046 864	2 257 698	1 590 689
1906	2 423 374	2 766 488	1 691 565	1 184 211
1907	2 108 450	2 214 090	1 137 279	757 730
1908	1 988 874	1 813 622	623 588	441 136
1909	2 061 019	1 761 297	549 364	361 605
1910	3 364 255	2 939 818	292 760	147 202
1911	3 416 400	2 930 434	274 973	134 900
1912	4 495 842	3 488 931	287 693	142 165
1913	5 146 782	4 873 807	193 975	95 565
1914	5 667 728	5 088 677	232 076	115 117

It is quite probable that the production of portland cement will soon be over 6,000,000 barrels a year. Additional capacity is now being provided in the plant of the Millen Portland Cement Co. at Jamesville, which began operations in 1913. The company will install a second kiln of the same capacity as the original one, which was rated at 700 barrels a day. The mill of the Cayuga Lake Cement Co., according to current reports, will also be enlarged. A few years ago the Seaboard Portland Cement Co. erected a plant below Catskill on the Hudson river, but never placed it in operation. It has now been taken over by the Acme Cement Co., which has made extensive changes and improvements with the view to entering upon active operations during the present season.

CLAY

BY ROBERT W. JONES

Due to the decrease in building construction during the year 1914 the production of clay products, along with other building materials, fell off considerably from that of the preceding season. In four of the principal cities of the State that depend largely upon local materials for building purposes, the falling off in construction during 1914 as compared with 1913 amounted to an average of 22.1 per cent. In New York City alone, building construction fell off 16.8 per cent.

The following table gives the production of clay materials in the State during the last three years:

Production of clay materials

MATERIAL	1912	1913	1914
Common brick	$6 666 945	$5 938 922	$4 597 856
Front brick	109 657	99 736	105 439
Vitrified paving brick	382 984	576 970	680 226
Hollow brick	42 575	44 265	38 119
Fireproofing	230 833	276 053	245 034
Terra cotta	1 139 291	1 113 322	892 630
Fire brick and stove lining	380 005	371 408	331 671
Drain tile	122 571	134 199	92 938
Sewer pipe	77 644	154 646	81 000
Pottery	2 876 762	3 367 187	2 405 676
Miscellaneous	13 828	1 164	4 630
Total	$12 043 095	$12 077 872	$9 475 219

One hundred ninety companies or individuals were active during the year as compared with 204 during the season of 1913. One hundred thirty-three reported a production of common soft-mud building and 13 a production of wire-cut building brick, or all together 145 as compared with 159 for the preceding year. The aggregate number of common building brick manufactured during the season amounted to 932,759,000 as compared with 1,090,506,000 for 1913; their value was $4,597,856 against $5,938,922 for 1913. Of the number of common building brick produced, 55,071,000 were made by the stiff-mud, wire-cut process with a value of $365,-159 as compared with a value of $424,894 during 1913. All clay products, with the exception of vitrified paving brick, fell off in value. Paving brick made an increase of 15.1 per cent in value and 23 per cent in quantity over 1913.

Thirty-five counties reported a production of clay products; of this number, 34 had a production of common building brick. Onondaga county held first place in the industry with a production of $1,556,093. The other leading counties were Ulster with a value of $895,126; Erie with $819,427 and Rockland with $747,026. The only counties that reported increases in production were Cattaraugus, Cayuga, Chautauqua and Westchester.

Production of clay materials by counties

COUNTY	1912	1913	1914
Albany	$457 694	$473 325	$369 312
Allegany	*a*		
Broome		*a*	*a*
Cattaraugus	231 156	275 763	334 557
Cayuga	3 740	5 800	8 765
Chautauqua	113 315	147 451	168 134
Chemung	79 510	*a*	*a*
Clinton		*a*	*a*
Columbia	381 888	307 571	198 866
Dutchess	665 082	634 043	430 269
Erie	810 516	1 000 055	819 427
Greene	202 306	290 116	196 889
Jefferson	3 630		
Kings	574 805	539 002	449 839
Livingston	125 642	200 248	73 775
Monroe	246 264	278 145	168 463
Montgomery	14 400	*a*	*a*
Nassau	119 708	109 051	96 534
New York	56 884	*a*	
Niagara	22 357	55 469	38 213
Oneida	85 897	84 714	45 000
Onondaga	1 368 345	1 613 395	1 556 093
Ontario	341 617	470 638	68 762
Orange	615 155	472 465	319 500
Queens	613 605	651 328	472 616
Rensselaer	169 179	151 202	124 152
Richmond	723 875	588 534	454 646
Rockland	994 967	820 475	747 026
St Lawrence		*a*	*a*
Saratoga	516 632	460 223	255 562
Schenectady	539 928	579 158	354 872
Steuben	181 663	*a*	*a*
Suffolk	92 150	81 000	69 300
Tompkins			*a*
Ulster	1 296 779	1 077 655	895 126
Warren	17 875	*a*	*a*
Washington	19 620	14 625	10 186
Wayne	*a*	*a*	
Westchester	344 798	290 256	321 826
Other counties *b*	12 113	406 165	427 509
Total	$12 043 095	$12 077 872	$9 475 219

a Included under other counties.
b In 1912, aside from counties marked *a*, are Clinton, St Lawrence, Tompkins and Wayne counties. In 1913 and 1914 are included counties marked *a*.

COMMON BUILDING BRICK

The State can be conveniently divided into five common-brick manufacturing districts, according to the materials and methods of manufacture. The first and most important is the Hudson river tidewater region extending from Croton Point on the south to and including Rensselaer and Albany counties on the north. The entire output of this region, with the exception of a small quantity produced in Albany and Rensselaer counties, is disposed of in the metropolitan district that includes New York, Jersey City and environs. The total product of this section during the season of 1914 was 709,877,000 brick with a value of $3,346,430 as compared with 788,731,000 and a value of $4,176,406 for 1913. This section consists of five main producing areas, with some outlying yards. The next important section of the State is farther north in the Hudson valley around Mechanicville; this district reported a total of 50,416,000 brick with a value of $240,912 as compared with a production of 89,744,000 for 1913. Nearly the entire output of this section is sold in the New England markets. Another important section is Long Island and Staten Island whose product is disposed of in the southern New England states and in the local markets. The output for the past season was 57,735,000 brick valued at $276,832 as compared with 59,004,000 and a value of $331,071 for 1913. Erie county is the other district with a production of 40,015,000 valued at $244,116 as compared with 56,899,000 and a value of $380,153 for 1913.

Production of common building brick by counties

COUNTY	1913 Number	1913 Value	1914 Number	1914 Value
Albany	66 700 000	$370 425	58 625 000	$301 512
Broome	*a*	*a*	....	....
Cattaraugus	800 000	8 000	*a*	*a*
Cayuga	800 000	4 800	820 000	4 740
Chautauqua	5 352 000	35 962	3 740 000	34 726
Chemung	*a*	*a*	*a*	*a*
Clinton	*a*	*a*	*a*	*a*
Columbia	58 585 000	307 571	44 705 000	198 866
Dutchess	120 770 000	634 043	91 580 000	430 269
Erie	56 899 000	380 153	40 015 000	244 116
Greene	26 976 000	143 466	25 604 000	123 475
Livingston	*a*	*a*	*a*	*a*
Monroe	19 747 000	99 064	11 330 000	63 650
Montgomery	*a*	*a*	*a*	*a*
Nassau	15 997 000	102 531	15 352 000	88 300
Niagara	8 067 000	55 469	*a*	*a*
Oneida	11 860 000	78 088	6 450 000	43 000
Onondaga	19 800 000	139 150	21 800 000	147 250
Ontario	2 000 000	16 000	*a*	*a*
Orange	96 493 000	472 465	75 500 000	319 500
Rensselaer	12 600 000	75 550	5 025 000	28 000
Richmond	29 507 000	147 540	29 583 000	119 232
Rockland	156 281 000	820 475	150 183 000	747 026
St Lawrence	*a*	*a*	*a*	*a*
Saratoga	91 745 000	458 723	51 916 000	248 412
Steuben	*a*	*a*	*a*	*a*
Suffolk	13 500 000	81 000	12 800 000	69 300
Tompkins	....	....	*a*	*a*
Ulster	197 801 000	1 077 655	202 366 000	895 126
Warren	*a*	*a*	*a*	*a*
Washington	*a*	*a*	*a*	*a*
Westchester	52 525 000	275 756	56 289 000	302 656
Other counties *b*	25 701 000	158 036	29 076 000	188 700
Total	1 090 506 000	$5 938 922	932 759 000	$4 597 856

a Included under other counties.
b Includes in 1913 and 1914 all counties marked *a*.

Hudson River region. The decrease in building operations in the territory tributary to this district naturally affected the manufacture of brick, which showed a further decline from the very low mark registered in the preceding year. It is estimated that about 350,000,000 brick were carried over into the 1914 season, a quantity much larger than had remained on hand in the few preceding years, so that the producers started with a considerable handicap. The stock was more than sufficient to meet the needs

of the market before the new product began to be shipped, and consequently the conditions rapidly became worse when the yards got under way. Those manufacturers who depended on the first sales to finance their summer operations had to dispose of their shipments on any terms. In the case of the leased yards the prices received were below the actual cost of production. Some manufacturers, as a consequence, ceased operations as quickly as they could, and were out of business the rest of the season. No substantial change for the better occurred as the season advanced and the market held at about the same level throughout the year. The average price received for the entire sales of the year in the region was $4.77 a thousand as compared with $5.37 a thousand in 1913, showing a falling off of 11.2 per cent. This was the lowest average reported since 1910. The prices are for the brick at the yards, and not the New York quotations which average about $1.25 a thousand higher, the difference representing the cost of transportation and commission exacted by the selling agents.

Output of common brick in the Hudson River region in 1913

COUNTY	NUMBER OF OPERATORS	OUTPUT	VALUE	AVERAGE PRICE A THOUSAND
Albany	12	66 700 000	$370 425	$5 55
Columbia	5	58 585 000	307 571	5 25
Dutchess	18	120 770 000	634 043	5 25
Greene	7	26 976 000	143 466	5 32
Orange	8	96 493 000	472 465	5 00
Rensselaer	4	12 600 000	74 550	5 97
Rockland	21	156 281 000	820 475	5 25
Ulster	24	197 801 000	1 077 655	5 50
Westchester	7	52 525 000	275 756	5 24
Total	106	788 731 000	$4 176 406	$5 37

Output of common brick in the Hudson River region in 1914

COUNTY	NUMBER OF OPERATORS	OUTPUT	VALUE	AVERAGE PRICE A THOUSAND
Albany	11	58 625 000	$301 512	$5 14
Columbia	5	44 705 000	198 866	4 45
Dutchess	14	91 580 000	430 269	4 69
Greene	5	25 604 000	123 475	4 82
Orange	6	75 500 000	319 500	4 23
Rensselaer	2	5 025 000	28 000	5 57
Rockland	25	150 183 000	747 026	4 30
Ulster	23	202 366 000	895 126	4 42
Westchester	7	56 289 000	302 656	5 37
Total	98	709 877 000	$3 346 430	$4 77

The output of the region was contributed by 98 firms, as compared with 106 in 1913, the smallest number at any time within the last decade. The average for each operator was also lower than in any recent year.

The yards that ship by water have a total machine capacity of about 11,000,000 brick a day, which represents the outturn of about 500 soft-mud machines. The principal districts include Haverstraw, Kingston and Dutchess Junction, but there are one or more yards at a number of other places.

The Haverstraw district includes the section along the river front from the southern limits of Haverstraw north through Grassy Point and North Haverstraw, a distance of about 3 miles, and embraces all the producers in Rockland county. It has the largest capacity of any district, the rated machine capacity being about 2,950,000 a day. There are 26 different yards, of which 25 were in operation last year. The output was 150,183,000 brick, worth $747,026, which was only a little less than in 1913. Most of the yards in the district are worked under lease, a fixed royalty being paid for each thousand of green brick made. Four yards get their clay from the river bottom by dredges, while the others have pits or banks back of their plants.

The Kingston district extends along the river for a distance of about 12 miles, including the yards at Port Ewen, East Kingston, Glasco, Saugerties and Malden. The number of operators last year was 22, and the output amounted to 199,366,000 valued at $878,626, or about the same number as in 1913. The total production of Ulster county was 202,366,000 valued at

$895,126. The available machine capacity is 2,900,000 a day. The yards in this district are mostly open and hand labor is used largely in excavating and tempering the clay. One company uses clay dredged from the river bed.

The yards around Dutchess Junction, Dutchess county, reported a total product of 88,580,000 brick worth $410,769. The corresponding figures for 1913 were 112,723,000 with a value of $591,796. The output of the whole county amounted to 91,580,000 valued at $430,269. The number of operators in the district was 13 and in the county 14, as compared with 16 and 18 respectively in 1913. The yards of the district have an available capacity of 1,936,000 brick a day, but not all were active.

In Westchester county seven producers reported an output of 56,289,000 worth $302,656, against 52,525,000 worth $275,756 in the preceding year. Most of the yards are situated along the river between Croton Point and Verplanck Point, where a machine capacity of 1,122,000 is available. A large part of the output is marketed within the county which contains a number of thriving cities and communities, so that the prices are apt to vary considerably from the New York quotations, the average in most years being higher.

Of the output of Albany county, which amounted last year to 58,625,000 valued at $301,512, a little less than one-half was sold locally and the remainder shipped to the lower Hudson markets. The yards that manufacture brick for shipment are situated at Coeymans, while the others are located at Cohoes, Watervliet and Albany.

Rensselaer county usually does not ship any brick, the output being consumed in Troy and vicinity. Only two operators reported as active last year, against four in 1913, and their output was 5,025,000 valued at $28,000. The average selling price was the highest of any of the Hudson river counties, $5.57 a thousand.

FRONT BRICK

The output of front brick includes different grades. The red and buff brick are simply selected common brick made by the stiff-mud process under the same conditions as those obtaining in the manufacture of the common variety. Greater care, however, is exercised in the burning and the product is carefully sorted as to color. The buff brick are made only in Richmond county. Rough-faced tapestry brick are made by the shale brick yards which also produce paving brick. They are burned in the same kilns with

the latter, occupying from two to six courses at the bottom where the temperature does not rise high enough for the thorough vitrification required in pavers. The roughened surface is secured by means of a wire placed near the die of the press so that it drags over the surface of the clay ribbon as this comes from the machine. Another class of front brick consists of dry-pressed brick. The production in 1914 consisted of 3,000,000 red smooth-faced brick valued at $30,000, 4,151,000 rough-faced brick valued at $39,205 and 3,331,000 dry-pressed brick valued at $36,234, aggregating altogether 10,482,000 valued at $105,439. In 1913 the output was 9,355,000 valued at $99,736.

COMMON HOLLOW BRICK

There were seven producers of common hollow brick last year who reported an output of 6,402,000 with a value of $38,119, as compared with nine producers in the preceding year with a reported outturn of 7,631,000 worth $44,265. Common hollow brick are made by the same methods as those used for hollow building blocks. Both clays and shales are employed and the molding is by the stiff-mud process, the brick being end cut. There are two forms — headers and stretchers. They are used chiefly for the construction of an inside course upon common building brick or fireproofing. The output is consumed in the larger cities.

FIREPROOFING

Fireproofing was made by seven companies, the same number as in 1913, who reported an output valued at $245,034. The total for the preceding year was $276,053. The material classed as fireproofing is reported under the names of terra cotta lumber, fireproofing, hollow tile and hollow building block. It includes many different shapes and sizes that are used in the construction of sidewalls, floors, arches and partitions, but not common hollow brick, which latter are used for veneering and not in the main construction. It is made by the stiff-mud process out of clays or shales, or a mixture of the two, according to the local conditions, and is burned in round downdraft kilns. The market for the material has increased steadily, with the exception of the past year when all building operations were greatly curtailed.

PAVING BRICK

A large gain in the production of paving brick was reported last year, this industry furnishing one of the few exceptions to the general record of depression. The number made was 46,696,000,

an increase of about 30 per cent for the year, and the largest output in the history of the industry. The demand for paving brick has developed rapidly with the growing recognition that they are one of the few materials which will withstand the hard usage of modern street traffic. In the last few years particularly they have come into general favor and are now being utilized for the rebuilding of many highways throughout the State. In the year 1914 a total of 49,374,169 paving brick were laid on State roads, or more than the local production. Most of the output of the local yards was shipped outside, less than one-fourth being used within the State. The production of paving brick in the last decade is given in the accompanying table.

Production of paving brick in New York

YEAR	QUANTITY	VALUE	VALUE A THOUSAND	NUMBER OF PLANTS
1905	13 984 000	$180 004	$12 87	6
1906	11 472 000	178 011	15 51	5
1907	12 296 000	184 306	14 98	4
1908	14 570 000	211 289	14 50	5
1909	12 278 000	207 970	16 27	3
1910	19 762 000	333 511	16 88	4
1911	23 993 000	388 479	16 19	4
1912	18 249 000	382 984	15 78	5
1913	35 666 000	576 970	16 17	6
1914	46 696 000	680 226	14 56	6

TERRA COTTA

The production of terra cotta is carried on by several plants in the southern part of the State. The materials used are brought in from New Jersey, with the exception of some clays used in glazing. The output in 1914 had a value of $892,630, which as compared with the value of $1,113,322 reported in the preceding year, represented a decline of 10 per cent. The unsettled business conditions accounted for the decline.

DRAIN TILE

The entire output for the year had a value of $92,938 and was produced by fourteen firms operating in Albany, Cayuga, Erie, Monroe, Oneida, Onondaga, Ontario, Saratoga, and Washington counties. The falling off from the preceding year when the pro-

duction had a value of $134,199 was due mostly to the reorganization and temporary closing of a few plants whose entire output was sold to the export trade. The remaining production chiefly sold for local consumption remained in about the same condition.

POTTERY

For the first time in many years the pottery industry showed a decided falling off in activity and interrupted the steady gain which has marked the course of production. The decrease amounted to nearly 30 per cent, mainly affecting the electrical porcelain business. The table below gives the value of the production for the last three years.

Value of production of pottery

WARE	1912	1913	1914
Stoneware	$46 024	$37 077	$28 888
Red earthenware	29 697	35 790	31 806
Porcelain and semiporcelain	1 038 428	1 143 835	1 129 629
Electric and sanitary supplies	1 727 553	2 100 985	1 187 506
Miscellaneous	35 060	49 500	27 847
Total	$2 876 762	$3 367 187	$2 405 676

CRUDE CLAY

Four counties reported a production of crude clays. The greater portion of this output was sold under the name of slip clay and was used mainly in the manufacture of porcelain electric insulators, although a small amount was produced for use in the manufacture of decorative terra cotta and for bonding purposes. Onondaga county produced some red burning clays for use in the manufacture of red ware. Richmond county made the only production of a white or light burning clay. The total production of crude clays amounted to 7109 tons having a value of $12,424. Of this amount, 4,703 tons with a value of $10,407 were slip clays.

At present slip clays are used mainly in the production of glazes for porcelain electric insulators, and therefore have to be of such quality that they will fuse at a comparatively low temperature and in a quiet manner and yield a glaze that will be able to stand up under the extreme condition of a very high voltage current. Such

clays have been reported from only a few localities, the largest deposits being found in the Hudson valley. The clay beds of this area cover a section extending along both banks of the river for a distance of about 40 miles south of the city of Troy. Not all the clays in the area are slip clays.

The clays found in the Hudson valley were deposited in the waters of Lake Albany, a glacial lake which at one time occupied a section of the valley from Rhinecliff north to the Battenkill. The clays are underlain mostly by soft gray and black shales and sandstones of Ordovicic age. The grinding action of the ice reduced the surface portions of the shales to a very fine condition and the material then was carried by the waters from the melting glacier into the lake where they were deposited to form beds of clay more or less free from sand and gravel. The sediments deposited in the lower section of the valley and from Troy north carry a larger quantity of sand and also are considerably higher in alumina than those in the middle section where the sediments were deposited in the more quiet waters of the lake. The clays later were subjected to the action of circulating waters which lowered the percentage of calcium, magnesium, sodium and potassium in the surface layers and resulted in the formation of a brown or yellow clay that reaches an extreme thickness of 40 or 50 feet. The line between the yellow and unaltered blue clay is very sharp. In one or two localities the beds of yellow or brown clay are absent, the section consisting of from 4 to 10 feet of bluish fine-grained sand usually underlying a bed of yellow medium-grained sand. This bluish sand is so finely comminuted that 95 per cent will pass a 100-mesh screen. The sand grains retained on the 40-mesh and 60-mesh screens consist of angular fragments of limestone with a few scattered grains of clear quartz. Those retained on the 80-mesh and 100-mesh consist almost entirely of colorless or iron-stained grains of quartz with a few scattered grains of limestone and undecomposed shale or slate. Following these sand layers there is an average of 20 feet of alternating thin layers of fine-grained blue or purple plastic clay and very thin layers of blue or gray sand. Below this comes the true slip clay. This consists of beds of blue very plastic clay alternating with thin layers of sand. In other places the successions from the surface is fine sand, yellow clay and blue clay. The lower layers of the slip clay are sometimes found with a thickness of as much as 6 feet, free from sand. The chemical change due to circulating waters has in no case reached a greater depth than the

middle of the upper thin layers of the slip clay. At the junction of the yellow and blue clays there is usually found a layer of concretions consisting mostly of calcium carbonate.

The ordinary blue clays are usually very plastic and require about 29 per cent water in order to place them in condition for proper working when used in the manufacture of soft-mud brick. The air shrinkage is about 6 per cent, and when burned at cone 1 (about 1150°C) there is no fire shrinkage. The burned product is of a pink color and is usually comparatively soft. The brown clays require about 26 per cent water for proper working and have an air shrinkage of 7.5 per cent. Burned at 1150°C there is a fire shrinkage of 1.5 per cent, giving a very red, dense vitreous product.

The slip clays are produced mainly in the vicinity of Albany. No attempt has been made to open pits or banks on an extensive scale, and no method of artificial drying is attempted by those engaged in the slip clay trade exclusively. The clays are shoveled from the banks, placed on racks to be dried by the heat of the sun and then drawn to the railroad siding and loaded.

Chemical analysis of the slip clays shows that there is considerable variation in the percentages of the ingredients but that the alumina is usually low, considerably below that present in the brick clays. The following analyses illustrate the composition of the slip clays of the Hudson valley.

	1	2	3	4	5
SiO_3	59.04	58.44	60.76	57.64	59.68
Al_2O_3	11.80	15.65	12.00	15.29	14.16
Fe_2O_3	5.56	3.43	2.50	2.20	1.76
TiO_2	1.00	.90	1.10	.95	.90
CaO	7.81	7.02	7.12	6.70	6.68
MgO	3.00	5.18	4.40	4.98	4.84
K_2O	2.29	2.28	2.73	2.75	2.75
Na_2O	.53	.29	.49	.41	.40
Moisture	.93	.75	.64	1.45	.65
Ignition	....	6.59	7.92	7.73	7.75
Total	....	100.53	99.66	100.10	99.57

1 Slip clay from Albany, upper banded layers.
2 Slip clay from Albany, upper banded layers.
3 Slip clay from Albany, lower massive beds.
4 Slip clay from Albany, lower massive beds.
5 Slip clay from Albany, average sample of bank.

FELDSPAR

The production of feldspar for the various uses which it serves has been carried on in New York for many years. The industry, however, is comparatively small, embracing four or five active quarries with a combined output that has ranged recently from 10,000 to 25,000 tons a year. There is evidently an increasing demand for the material which, in view of the abundant local supplies and their favorable situation with respect to the principal markets, should bring the industry into greater prominence. A detailed description of the feldspar deposits, both developed and undeveloped, has been prepared recently by the writer and will be included as a separate chapter in a report on the quarry materials of New York now in press.

The sources of feldspar are the pegmatite bodies which accompany the crystalline formations of the Adirondacks and the southeastern Highlands. The pegmatites are abnormally coarse-grained granites, consisting of feldspar, quartz and mica, with minor amounts of other minerals, some of which are peculiar to this association. They occur in rather limited bodies which assume the shape of dikes, lenses or small bosses, intrusive in the surrounding formations, and represent offshoots from a granite magma which may or may not outcrop in the vicinity. The coarse grain of pegmatite is its most apparent characteristic, for the different ingredients assume dimensions many times larger than those characteristic of ordinary granite, the feldspar being in crystals or masses that range up to several feet in diameter and the quartz and mica in proportionately large individuals. As a consequence, the separation of the minerals can be effected usually without much difficulty by means of hand cobbing in the quarry.

The products of the pegmatite quarries include feldspar, quartz and mica which are marketed separately, and unsorted crushed pegmatite which recently has come into demand for various purposes. The feldspar may belong to one of several varieties, such as orthoclase and microcline which contain potash, or albite and oligoclase which belong to the soda-lime series. The composition of the mineral determines to some extent the uses that may be made of it and should be investigated, therefore, before any deposit is developed for quarry purposes. The potash varieties are the ones used for pottery, for which purpose they are also required to be free of iron and fairly free of intergrowth with quartz. Albite is valuable for the glazing of building tile and terra cotta;

manufacturers of these materials show a preference for it over potash spar owing to its lower fusing point.

The unsorted pegmatite which is a mixture of feldspar, quartz and mica in varying proportions is employed in making prepared roofing, in the manufacture of artificial stone, for concrete, poultry grit and other purposes. Artificial stone differs from ordinary concrete in that an attempt is made by the use of selected aggregates to render the product attractive to the eye and to imitate more or less closely natural stone.

The quartz of pegmatites may have value when it is present in such form that it is readily separable from the feldspar. It is an important product, for example, at the Kinkel quarries near Bedford. Mica is produced in minor quantities from the pegmatites that are worked for feldspar.

The quantity of feldspar and unsorted pegmatite produced last year by the New York quarries was 18,487 short tons valued at $97,192. This was a little below the output for the preceding year, which was reported as 19,680 tons valued at $99,765. The greatest output in any single year was in 1912 when it amounted to 24,584 short tons worth $106,419. The value of the feldspar varies with the quality and its state of preparation. Selected crude spar has sold recently for $4.50 and $5 a ton. The ground spar for enamel and similar purposes is worth from $7 to $8 and for pottery $8 to $10 a ton. Unsorted crushed pegmatite brings about $3 a ton at the mill.

The quarries now in operation are situated in Essex and Westchester counties. The Crown Point Spar Co. and the Barrett Manufacturing Co. work quarries in the former county at Crown Point and Ticonderoga respectively. Their main products are unsorted pegmatite. In Westchester county, near the village of Bedford are the quarries of P. H. Kinkel & Sons and the Bedford Spar Co. which produce spar for grinding.

GARNET

The output of abrasive garnet in the past year was obtained from the usual sources — the deposits in the vicinity of North Creek, Warren county. For many years these deposits have contributed the larger part of the supply that has been mined in the country, which means practically the supply for the whole world, since the output in foreign countries is limited to a few hundred tons annually and is mainly from a single district in Spain. The

employment of garnet as an abrasive is peculiarly an American development, and although firmly established in certain manufacturing lines here, as shown by the steady demand in spite of the very active competition of other abrasives natural and artificial, apparently it has made little progress in foreign countries.

The Adirondack deposits have been repeatedly described in the reports of the New York State Museum and elsewhere so that there is no need to discuss their features at length in this place. Briefly, they consist of various gneisses and massive rocks which carry disseminated crystals and aggregates of garnet of the variety known as almandite. In some places, as instanced by the Rogers mine on Gore mountain, the garnet is found in crystals that range up to several feet across and weigh a ton or more, but elsewhere the mineral is mostly in individuals that measure an inch or less in diameter. The larger individuals seldom show any outward crystal development but have rounded or lenticular outlines and are traversed by innumerable fractures or parting planes. When the crystals are broken into, the particles of garnet are picked out by hand with the aid of cobbing tools, such garnet being known as shell and pocket garnet. This method of hand work, with the aid of blasting to break up the rock, is practised on Gore mountain where the conditions are exceptionally favorable for its use on account of the relative richness of the rock and the large size of the crystals. In the other deposits the rock is quarried with no attempt at sorting and is then crushed in mills to a size which releases the garnet from the matrix. The mineral is removed from the crushed product by treatment in jigs or by pneumatic separators. The mechanical separation yields a clean concentrate, although there is a small margin between the specific gravity of almandite and that of the hornblende which is an important constituent of the rock.

The utility of garnet for abrasive purposes depends upon its hardness, toughness and cleavage or fracture. Almandite, which is the variety employed, is usually assigned a hardness of 7 to 7.5 by mineralogists; that is, it exceeds quartz in that respect but is not quite so hard as topaz. It appears that Adirondack almandite of the crystal variety possesses superior hardness, and is rated as 7.5 or 8. Toughness and strength are important qualities, especially when the abrasive is used under considerable pressure. A material may be very hard and yet brittle or crumbly under pressure. The well-crystallized almandite, free from impurities, has great strength and gives good service on polishing machines. The presence of

mica and chlorite is an element of weakness, inasmuch as they provide surfaces along which the garnet fractures more or less readily. An imperfect cleavage or parting that results from regional compression, however, is not detrimental and may be an advantage if not too pronounced. The color of garnet can not be used as a criterion of quality, but abrasive manufacturers usually express a preference for the dark shades which show a good red color when applied to paper or cloth. It is important, also, that the garnet crystals be sufficiently large so that when crushed and separated from the rock matrix the garnet will not be too fine but will afford the desirable assortment of sizes. The normal result of milling a small crystal is to produce an excess of the finer sizes. Much of the garnetiferous rock that occurs in various parts of the Adirondacks and elsewhere can not be utilized because of the small crystal, if for no other reason.

Besides the Adirondacks, North Carolina and New Hampshire have supplied some abrasive garnet in recent years, and mines now inactive are found in several other states within the Appalachian metamorphic belt.

The wood-working and leather manufacturing industries are the principal consumers of garnet which is used in the form of garnet paper and garnet cloth. "Ruby" paper is a common name for the manufactured material. Its efficiency is said to be several times greater than ordinary quartz sandpaper.

The garnet mines in the Adirondacks were first developed for commercial production about 1882. The earliest operations were on Gore mountain, in connection with the remarkable deposit known as the Rogers mine. This is by far the richest of the mines and as already stated is worked by hand. The output for the first few years probably did not amount to more than a few hundred tons annually. By 1893, however, it had grown to 1475 tons, according to figures published in *The Mineral Industry*. The next important development came with the introduction of mechanical methods for the separation of the garnet, due to the initiative of the Messrs Hooper who constructed the first mill on a property lying a little west of North River in the town of Minerva, Essex county. The garnet here occurred in smaller crystals than in the Rogers mine and could not be economically handled by the methods adopted at that mine. The North River Garnet Co. later built a mill which it now operates on Thirteenth lake, Warren county, the first mill having been dismantled. The production of garnet from 1904 to date has been as follows:

Production of Garnet

YEAR	SHORT TONS	VALUE
1904	3 045	$104 325
1905	2 700	94 500
1906	4 729	159 298
1907	5 709	174 800
1908	2 480	79 890
1909	3 802	119 190
1910	5 297	151 700
1911	4 285	121 759
1912	4 112	117 325
1913	4 665	145 445
1914	4 026	134 940

The statistics show that the production has continued fairly steady from year to year, but does not manifest any marked growth. The value of the product has remained at about the same level also, the prices ranging around $30 and $35 a ton, depending on the quality. The mill product when it is clean crystal garnet of good color commands the highest prices.

The garnet is practically all sold in this country. The domestic manufacturers also import some garnet from Spain where it is obtained by the washing of river sands. This garnet is of fine size and hence finds a rather limited application. It is said to cost about $15 a ton laid down at the Spanish seaboard, which is much less than the cost of mining the Adirondack mineral.

The imports for the year 1914, as given by the collectors of customs at the ports of New York and Boston, were 1244 short tons with a declared value of $20,277. In 1913 they amounted to 547 short tons with a value of $8078.

GRAPHITE

The usual output of crystalline graphite was made last year in the Adirondack region, and as heretofore the main source of supply was the American mine at Graphite, Warren county, which has had a long record as a producer. The mine affords a very light, flaky graphite that commands a special market. The graphite occurs in disseminated condition through the body of a hard quartzite, requiring special methods for its extraction and preparation, which have been perfected by the owners of the mine, the Joseph Dixon Crucible Co. The rock is crushed and the graphite extracted in a mill situated at the mine, and the crude product is then refined and finished at a second plant in Ticonderoga.

The occurrence of graphitic quartzites has been shown by prospecting to be quite common in the eastern section of the Adirondacks, in Warren, Washington and Essex counties, and considerable deposits occur also in the northwestern part in St Lawrence county. The separate areas represent, apparently, the broken, eroded remnants of once extensive beds which belong to a single formation. They are interbedded with crystalline limestones, schists and garnetiferous gneisses that belong to the Grenville series of the early Precambric. The stratigraphic position of the quartzites in the bedded series has not been determined, owing to their greatly disturbed and eroded condition. The quartzites and quartz schists are hardened sandstones, and the graphite almost certainly is of organic origin, derived from plant or animal remains included in the rocks at the time of their deposition. The graphite content is quite constant within the same layers of a deposit, though it may vary considerably in a direction at right angles to the bedding planes. There is great variation in the graphite percentages in the different occurrences, the richest deposits carrying around 8 or 10 per cent, whereas the usual average is not over 2 or 3 per cent. Rock with less than 5 per cent can not be considered as within the range of economic utilization. There are other factors that have to be considered in addition to the graphite tenor, such as the size of flake, the presence of other scaly minerals, and the degree of crushing that is necessary to effect a separation of the graphite from the gangue. Very rarely does a deposit possess all the requisites for economic production; in fact the American mine is the only one of a number of enterprises to win a permanent success in the industry.

One of the commoner difficulties in the way of utilizing the Adirondack deposits pertains to the presence of more or less mica which is disseminated usually through the quartzite in intimate association with the graphite. The particles are of approximately similar size, and being of the black variety (biotite) they may be readily overlooked in the hand specimen or in the graphite concentrate. The easiest method of detecting the mica and of estimating its relative proportion to the graphite is to examine the material under the microscope when the former can be readily distinguished by its translucency. The results of previous experience in mill treatment with the use of buddles, concentrating tables, pneumatic jigs and screens have shown that the mica can not be eliminated by such methods. There is a possibility that this difficulty may be overcome through the use of an electrostatic process, such as has been perfected in recent years and applied with some success to the metallic

ores. The process, it may be explained in a word, makes use of the differences of electric conductivity in the separation of minerals; inasmuch as graphite is a good conductor and mica a very poor one there seems to be a basis at least for experimentation in this field.

GYPSUM

The gypsum mines of the State were not quite so actively worked last year as in the preceding season, but still yielded a large output. The decrease in tonnage which was of small proportions may be attributed to the poor market for calcined products which in turn was influenced by the decline of building operations throughout the East. The market for gypsum plasters for a time was oversupplied and became almost demoralized by the competition among mills for the little trade that existed. In some building centers these products were offered at prices which left little or no profit to the manufacturer. In view of the enormous development of the industry that has taken place in the last few years it is but natural that the production finally should reach a point where it equaled or exceeded the requirements, a condition that obtained last year for the first time. With the resumption of normal activity in the market the industry doubtless will rapidly recover from the depression.

The production of gypsum last year was reported from four counties — Onondaga, Monroe, Genesee and Erie. There are several others that contain deposits, since the district extends all the way from Madison county on the east to the Niagara river, but the present mine localities have certain advantages as to quality of the rock or for economic extraction and marketing of the materials. The thickest deposits are found in the east in Onondaga, Cayuga and Madison counties where they attain a maximum of from 15 to 40 feet. The grade is somewhat inferior, however, the gypsum being intermixed with clayey and calcareous impurities and having a rather dark color. These deposits consequently are not employed generally for calcined plasters, but are useful as sources of agricultural plaster. In Monroe, Genesee and Erie counties, the deposits are much thinner, averaging 4 or 5 feet in most places, but have a higher purity so that the rock is well adapted for practically all purposes. Most of the output in these counties is calcined, but a fairly large proportion is sold crude to cement manufacturers.

The total output was 513,094 short tons or about 20,000 tons less than in 1913. The following table shows the output distributed according to uses for the two years.

Production of gypsum

MATERIAL	1913		1914	
	Short tons	Value	Short tons	Value
Total output, crude	532 884	....	513 094	....
Sold crude	183 597	$265 879	169 257	$246 804
Ground for land plaster	8 521	17 807	7 096	15 342
Wall plaster, etc. made	306 206	1 022 457	297 084	985 258
Total	....	$1 306 143	....	$1 247 404

There were few new developments in progress during the year. Prospecting was practically at a standstill, but will doubtless be resumed once the conditions begin to improve. The developed ground in the western section is confined to a few areas which are controlled by the present mining companies, and the future growth of the industry will depend upon the discovery of additional deposits. The number of active mines was eight, one less than in 1913. In the Akron district, the Akron Gypsum Products Corporation became a producer, having taken over the mines and mill formerly owned by the Akron Gypsum Co.

IRON ORE

The iron trade was greatly depressed throughout 1914, and the output of ore consequently showed a marked decline as compared with the production for the few preceding years. The curtailment of demand was accompanied by a lowering of prices which worked to the special disadvantage of the local industry owing to the fact that most of the output is now made from low-grade milling ores that involve treatment in elaborate plants with heavy costs of operation.

Besides the decreased demand and falling prices another factor that discouraged activity was the putting into effect of the new compensation act, the terms of which as applied to the mining industry were regarded by the operators as rather drastic. One of the companies that had been active for a number of years preferred to withdraw from business rather than comply with the conditions imposed by the law. Some time must elapse before the effects of the new regulations can be fully determined.

The production of furnace ores and concentrates as reported by the different mines that were operative within the State was 751,716 long tons. In comparison with the total reported for the preceding year, this represented a decrease of 466,183 tons, or nearly 40 per cent. It was the smallest output recorded in the last ten years with the exception of that for 1908. The value of the product at the mine was $2,356,517, or an average of $3.13 a ton.

Of the total, the magnetite represented 703,670 tons, with a value of $2,251,656. Hematite constituted the remainder with the exception of a few hundred tons of limonite from Columbia county. The hematite all came from the Clinton belt in Oneida and Wayne counties; the magnetite was mainly from the Adirondacks, with a smaller but important part from the mines in Orange county.

Production of iron ore in New York State

YEAR	MAGNETITE	HEMATITE	LIMONITE	CARBONATE	TOTAL	TOTAL VALUE	VALUE A TON
	Long tons	Long tons	Long tons	Long tons	Long tons		
1895	260 139	6 769	26 462	13 886	307 256	$598 313	$1 95
1896	346 015	10 789	12 288	16 385	385 477	780 932	2 03
1897	296 722	7 664	20 059	11 280	335 725	642 838	1 91
1898	155 551	6 400	14 000	4 000	179 951	350 999	1 95
1899	344 159	45 503	31 975	22 153	443 790	1 241 985	2 80
1900	345 714	44 467	44 891	6 413	441 485	1 103 817	2 50
1901	329 467	66 389	23 362	1 000	420 218	1 006 231	2 39
1902	451 570	91 075	12 676	Nil	555 321	1 362 987	2 45
1903	451 481	83 820	5 159	Nil	540 460	1 209 899	2 24
1904	559 575	54 128	5 000	Nil	619 103	1 328 894	2 15
1905	739 736	79 313	8 000	Nil	827 049	2 576 123	3 11
1906	717 365	187 002	1 000	Nil	905 367	3 393 609	3 75
1907	853 579	164 434	Nil	Nil	1 018 013	3 750 493	3 68
1908	663 648	33 825	Nil	Nil	697 473	2 098 247	3 01
1909	934 274	56 734	Nil	Nil	991 008	3 179 358	3 21
1910	1 075 026	79 206	4 835	Nil	1 159 067	3 906 478	3 37
1911	909 359	38 005	5 000	Nil	952 364	3 184 057	3 34
1912	954 320	103 382	Nil	Nil	1 057 702	3 349 095	3 17
1913	1 097 208	120 691	Nil	Nil	1 217 899	3 870 841	3 18
1914	703 670	47 705	341	Nil	751 716	2 356 517	3 13

The magnetite consisted largely of concentrates, some of the Adirondack mines shipping all their product in that form. A ton of concentrates, which on the average contains 65 per cent iron, represents from a little over 1 to 3 tons of crude ore, according to the grade of the particular ore body. The actual amount of magnetite

raised from the mines during the year was 1,074,175 tons; and the total quantity of ore of all kinds taken out was 1,122,221 tons. In 1914 the gross output amounted to 1,606,196 tons.

The list of the active mining companies for the year included the following in the Adirondack region: Witherbee, Sherman & Co., and Port Henry Iron Ore Co., Mineville; Cheever Iron Ore Co., Port Henry; Chateaugay Ore & Iron Co., Lyon Mountain; Benson Mines Co., Benson Mines. In southeastern New York the producers were the Hudson Iron Co., Fort Montgomery, and Sterling Iron & Railway Co., Lakeville. The hematite mines were operated by C. H. Borst, Clinton; Furnaceville Iron Co., Ontario Center; and Ontario Iron Co., Ontario Center. The single limonite mine was operated by Barnum, Richardson & Co., who shipped the output to their furnaces in Connecticut.

Mineville. The two Mineville companies supplied a little over one-half of the total product of furnace ore, but their output was considerably below that reported for 1913. Operations in the latter part of the year were hampered by the loss of milling capacity due to the burning of the two older mills, No. 1 and No. 2, on the Joker-Bonanza properties of Witherbee, Sherman & Co. This left only No. 3 and No. 4 mills on the Harmony and Barton Hill mines to handle the output. Construction work was immediately started upon a new magnetic concentration plant which will have a capacity equal to that of the mills that were destroyed, and which will treat the high-phosphorus ores of the Old Bed mine group.

The mines under active operation during the year included the Joker-Bonanza, Harmony and Barton Hill groups of Witherbee, Sherman & Co., and 21 and Clonan shafts of the Port Henry Iron Ore Co. In the Joker-Bonanza territory attention was directed mainly to the flat seam which underlies the main ore body and resulted in the further extension of the productive ground.

Lake Sanford. The most important recent development in connection with the titaniferous magnetites of this locality has been the experimentation in smelting the ores on a practical scale, for which purpose the MacIntyre Iron Co. secured a lease of the Port Henry blast furnace for a part of the past year and conducted a series of tests in the production of pig iron with varying portions of Lake Sanford magnetite in the charge. The interest and value of the tests are more than local, as they seem to have demonstrated the commercial utility of the great bodies of ore which the company owns in the Adirondacks and which doubtless it will undertake to bring into market.

The furnace tests are the subject of a very complete report[1] by F. E. Bachman, who as metallurgical expert and manager of the company was present during the trial. It appears that the magnetites involved no special difficulties in treatment, at least when employed to the extent of one-third or one-fourth of the charge, and therefore their use will not require any important modifications of present methods or equipment. For the metallurgical details, on which the conclusions here given are based, the report should be consulted.

The tests were made with concentrates prepared in a small experimental mill at the mines and also at the commercial mills (Nos. 1, 2 and 4) at Mineville. In none of the plants was the treatment of the crude ore very successful, since the iron content was not raised above 55 or 56 per cent, while the titanic acid averaged around 12 or 13 per cent. The quality of the concentrates may be considerably improved, when once the mill practice has been modified to meet the physical conditions of the ores which are not the same as those characterizing the nontitaniferous class. Previous experiments on a fairly large scale indicate that the iron may be brought up to about 60 per cent with a titanium content of 10 per cent or less.

In so far as the furnace tests are concerned, the results indicate that the Lake Sanford magnetites are no more refractory than the ordinary magnetites. The fuel consumption in the reduction of the iron actually may be lower, although counterbalanced by the somewhat greater proportion of slag produced to the unit of iron. The titaniferous slags are more fluid than those free of titanium, contrary to what has been commonly supposed, and there is less tendency for the furnace to hang and slip when operated on a titaniferous charge. The quality of the iron is good, numerous tests indicating that it is stronger than ordinary pig of the same silicon content. It contains less sulphur and the silicon is lower by an amount corresponding to one-half of the titanium content. The latter ordinarily does not exceed about one-half of 1 per cent. The iron contains up to one-tenth of 1 per cent of vanadium.

MILLSTONES

Millstones are quarried from the Shawangunk grit of Ulster county, one of the few sources of these materials in the United States. The industry was established there many years ago, and

[1] Amer. Iron and Steel Inst., Oct. 1914.

during the earlier period of its history was in a flourishing state as the product found a wide sale for the grinding of cereals. This market has been greatly curtailed within the last quarter of a century or more by the general use of the roller mill process for making flour, although some mills still make use of stones for grinding the coarse grains. The small corn mills in the South furnish one of the larger markets for the New York product. Besides millstones, the Ulster county quarries also turn out disks of stone known as chasers which are employed in a roll type of crusher, the disks revolving on a horizontal axis in a circular pan that is sometimes floored by blocks of the same stone. This type of crusher is much used in the grinding of minerals like quartz, barytes and feldspar, and paint materials.

The Shawangunk grit of which the stones are made outcrops on Shawangunk mountain, a monoclinal ridge that extends from Rosendale southwesterly into New Jersey and Pennsylvania. The grit forms the top of the ridge, dipping to the west in conformity with the slope of the surface, and in the Walkill valley along the north side disappears below shales and limestones which belong to the uppermost formations of the Siluric. The grit rests unconformably upon the Hudson River series. In thickness it ranges from 50 to 200 feet. The millstones are quarried within a limited section of the ridge, between High Falls on the north and Kerhonkson on the south, where the grit appears to be best adapted to the purpose. In character it is a light gray conglomerate with pebbles of milky quartz ranging in size from that of a pea to 2 inches in diameter. The pebbles are rounded and firmly cemented by a silicious matrix of gritty texture.

The work of quarrying requires only a small equipment, the stone being pried out by hand bars, after the use perhaps of the drill and plugs and feathers. Sometimes a little powder may be employed, but care has to be exercised in its use to avoid weakening the stone. The spacing of the natural joints determines the size of the stone that may be produced, the joints occurring in two sets approximately parallel to the dip and strike of the formation. The rough blocks thus obtained are reduced to shape by the hammer and point and then undergo a final tool dressing which varies with the use to which the stone is to be put. The hole or " eye " in the center is drilled by hand.

The sizes of the stone marketed ranges from 15 to 90 inches in diameter. The greater demand is for the smaller and medium sizes with diameters of 24, 30, 36, 42 and 48 inches. The chasers

are supplied in sizes that usually run from 48 to 90 inches and with widths up to 24 inches. The prices range from $3 for an 18 inch stone to $75 or $100 for the largest sizes.

The production at one time was valued at over $100,000 a year, but within the last decade it has averaged less than $20,000. During 1914 the total sales of millstones and chasers were reported as $12,410 as compared with $13,130, the value of the stones marketed in 1913.

MINERAL PAINT

For the purposes of the present report only the natural mineral pigments are included under this title. In addition to these materials, there is a production in the State of artificial pigments, especially those of lead, but as the substance used in their manufacture is derived from outside sources, they have not been included among the local products.

The crude paint materials that occur within the State include iron ore, ocher, shale and slate. Of the iron ores the Clinton hematite affords an excellent base for the manufacture of metallic paint and mortar color of red to brownish red colors. The beds with a relatively high iron content are employed, as they possess the softness and uniformity of texture, as well as depth of color which are requisite for such use. The ore is obtained from the mines at Clinton, Oneida county, owned by C. A. Borst and from those at Ontario, Wayne county, worked by the Furnaceville Iron Co. The hematite from the former locality is of oölitic nature and carries about 45 per cent iron. The ore from Ontario contains about 40 per cent iron and is known as " fossil " ore. In years past the red hematite from the northern part of the State has also been employed, but recently this ore has not been obtainable.

Both shale and slate from the local formations have been used quite extensively for pigments. They occur in various colors depending upon the amount and nature of the iron oxides present. A large percentage of ferric oxide lends a reddish color which resembles that of metallic paint. Red shale has been obtained from the base of the Salina beds near Herkimer. The red slate from Washington county is another material that has been quite extensively ground for pigment. At Randolph, Cattaraugus county, beds of green, brown and bluish shale occur in the Chemung formations and have been utilized in the past.

Deposits of ferruginous clay, or ocher, are found in many places within the State, but they are not now worked. Sienna, a dark

brown variety of ocher, is found near Whitehall where it was produced a few years ago.

The production of mineral paint and mortar colors in 1914 amounted to 7321 short tons, valued at $88,720. That of slate pigment was 1182 short tons worth $9620. In addition to these outputs of manufactured pigments, there was a considerable quantity of material produced that was shipped to points outside for grinding into pigments.

MINERAL WATERS

New York has held for a long time a leading position among the states in the utilization of mineral waters. The different springs, of which over two hundred have been listed as productive at one time or another, yield a great variety of waters in respect to the character and amount of their dissolved solids. There are some that contain relatively large amounts of mineral ingredients and are specially valuable for medicinal purposes; Saratoga Springs, Ballston Springs, Richfield Springs, Sharon Springs and Lebanon Springs are among the more noted localities for such waters. Numerous other springs are more particularly adapted for table use, containing only sufficient mineral matter to give them a pleasant saline taste. Both kinds of waters are generally carbonated and sold in small bottles.

Of late there has developed an important business in the sale of spring waters which can hardly be classed as mineral in the common acceptance of the word, but which are extensively consumed for office and family use in the larger towns and cities. Their employment depends upon their freedom from harmful impurities, in which feature they are generally superior to the local supplies. In so far as such waters are an article of commerce they may well be included in a canvass of the mineral water industry. They are usually distributed in large bottles or carboys in noncarbonated condition.

Character of mineral waters. Among the spring waters that contain mineral ingredients in appreciable quantity, those characterized by the presence of alkalis and alkaline earths are the most abundant in the State. The dissolved bases may exist in association with chlorin and carbon dioxid, as in the springs of Saratoga county, or they may be associated chiefly with sulphuric acid, as illustrated by the Sharon and Clifton Springs.

The mineral waters of Saratoga Springs and Ballston are found along fractured zones in Lower Siluric strata, the reservoirs occurring usually in the Trenton limestone. They are accompanied by

free carbon dioxid which, together with chlorin, sodium, potassium, calcium and magnesium, also exists in dissolved condition. The amount of solid constituents in the different waters varies from less than 100 to over 500 grains a bottle. Large quantities of table and medicinal waters are bottled at the springs for shipment to all parts of the country. The carbon dioxid which issues from the wells at Saratoga at one time was an important article of commerce, but its sale has been discontinued.

The waters at Richfield Springs contain the elements of the alkali and alkaline earth groups together with sulphuric acid and smaller amounts of chlorin, carbon dioxid and sulphureted hydrogen. They are employed for medicinal baths as well as for drinking purposes. The springs issue along the contact of Siluric limestone and Devonic shales. Sharon Springs is situated to the east of Richfield Springs and near the contact of the Lower and Upper Siluric. Clifton Springs, Ontario county, and Massena Springs, St. Lawrence county, are among the localities where sulphureted waters occur and are utilized.

The Oak Orchard springs in the town of Byron, Genesee county, are noteworthy for their acid waters which contain a considerable proportion of aluminum, iron, calcium and magnesium, besides free sulphuric acid.

The Lebanon spring, Columbia county, is the single representative in the State of the class of thermal springs. It has a temperature of 75° F. and is slightly charged with carbon dioxid and nitrogen.

Ordinary spring waters. The greater quantity of spring waters consumed in the State belongs to the nonmedicinal, noncarbonated class, represented by such springs as the Great Bear, Deep Rock, Mount View, Sun Ray, Chemung etc. The waters are obtained either by flowing springs or from artesian wells and are shipped in carboys or in tank cars to the principal cities where they are bottled and distributed by wagons among the consumers. The essential feature of such waters is their freedom from noxious impurities. This is generally safeguarded by the care exercised in the handling of the waters which are also regularly examined in the chemical and bacteriological laboratories.

Carbon dioxid. Carbon dioxid is given off in quantity by some of the wells at Saratoga Springs, and its collection and storage for shipment constituted for many years an important industry at that place. Over thirty wells have been bored there for gas alone. The industry has now been discontinued by force of a legislative enact-

ment; it was considered that the pumping of the wells for the production of the gas was detrimental to the other springs that were utilized solely for their waters. For some time the value of the natural gas secured from the wells exceeded that of the mineral water sales.

List of springs. The following list includes the names and localities of most of the springs in the State that are employed commercially, as shown by a canvass of the industry:

NAME	LOCALITY
Baldwin Mineral Spring	Cayuga, Cayuga county
Coyle & Caywood (Arrowhead Spring)	Weedsport, Cayuga county
Diamond Rock Spring	Cherry Creek, Chautauqua county
Breesport Oxygenated Spring	Breesport, Chemung county
Breesport Deep Rock Water Co	Breesport, Chemung county
Chemung Spring Water Co	Chemung, Chemung county
Keeseville Mineral Spring	Keeseville, Clinton county
Lebanon Mineral Spring	Lebanon, Columbia county
Arlington Spring	Arlington, Dutchess county
Mount Beacon Spring	Mount Beacon, Dutchess county
Mount View Spring	Poughkeepsie, Dutchess county
Monarch Spring Water Co	Beacon, Dutchess county
Elk Spring Water Co	Lancaster, Erie county
Clinton Lithia Springs, Inc	Franklin Springs, Oneida county
Glen Alix Spring	Washington Mills, Oneida county
Lithia Polaris Spring	Boonville, Oneida county
F. H. Suppe (Franklin Lithia Spring)	Franklin Springs, Oneida county
Orville Risley	New York Mills, Oneida county
Geneva Mineral Water Springs	Geneva, Ontario county
Crystal Spring	Oswego, Oswego county
Deep Rock Spring	Oswego, Oswego county
Great Bear Spring	Fulton, Oswego county
White Sulphur Spring	Richfield Springs, Otsego county
Black Rock Spring	Rensselaer, Rensselaer county
Mammoth Spring	North Greenbush, Rensselaer county
Shell Rock Spring	East Greenbush, Rensselaer county
Madrid Indian Spring	Madrid, St Lawrence county
Artesian Lithia Spring	Ballston Spa, Saratoga county
Comstock Mineral Spring	Ballston Spa, Saratoga county
Mohican Spring	Ballston Spa, Saratoga county
Arondack Spring	Saratoga Springs, Saratoga county
Hathorn (Nos. 1 and 2) Springs	Saratoga Springs, Saratoga county
Coesa Spring	Saratoga Springs, Saratoga county
Geyser Spring	Saratoga Springs, Saratoga county
Minnonebe Spring	Saratoga Springs, Saratoga county
Orenda Spring	Saratoga Springs, Saratoga county
Saratoga Gurn Spring	Saratoga Springs, Saratoga county
Saratoga Vichy Spring	Saratoga Springs, Saratoga county
Chalybeate Spring	Sharon Springs, Schoharie county
Eye Water Spring	Sharon Springs, Schoharie county
Sulphur-Magnesia Spring	Sharon Springs, Schoharie county
White Sulphur Spring	Sharon Springs, Schoharie county
Red Jacket Spring	Seneca Falls, Seneca county
Setauket Spring	Setauket, Suffolk county
Elixir Spring	Clintondale, Ulster county
Sun Ray Spring	Ellenville, Ulster county
Vita Spring	Fort Edward, Washington county
Briarcliff Lodge Association	Briarcliff Manor, Westchester county
Gramatan Spring Water Co	Bronxville, Westchester county
Orchard Spring	Yorkt'n Heights, Westchester county

NATURAL GAS

The natural gas industry had a slight setback last year, the production having fallen off in some of the more important districts. The decrease was the result of natural causes, not involved in any way with the general business depression, as shown by the fact that the value of the output actually was larger than in the preceding year. There were no discoveries of new pools to counterbalance the normal decline of flow in the older territory.

The flow of gas as reported by the individual producers and pipeline companies amounted to 8,714,681,000 cubic feet, as compared with 9,055,429,000 cubic feet in 1913, a decline of nearly 4 per cent. On the other hand, the value of the output, according to reports, reached $2,570,165 against $2,549,227, and was the largest that has ever been recorded. The value is based on the average prices received for the gas in the different centers of consumption. The average price for the whole State was 29.4 cents a thousand, as compared with 27.8 cents in 1913.

The production of gas in the State since 1904 when the statistics were first collected by this office, is shown in the accompanying table. In former years it has been feasible to separate the production according to the county or district in which it was made, but owing to the recent changes in the industry, particularly in the organization of large distributing companies who derive their supplies from different fields, the statistics can no longer be separated by counties.

Production of natural gas

YEAR	OUTPUT 1000 CU. FT.	VALUE	NUMBER OF WELLS
1904	2 399 987	$552 197	....
1905	2 639 130	607 000	....
1906	3 007 086	766 579	....
1907	3 052 145	800 014	925
1908	3 860 000	987 775	1 100
1909	3 825 215	1 045 693	1 280
1910	4 815 643	1 411 699	1 340
1911	5 127 571	1 547 077	1 403
1912	6 564 659	1 882 297	1 660
1913	9 055 429	2 549 227	1 750
1914	8 714 681	2 570 165	1 797

The returns for 1914 showed about 200 individual producers with a total of 1797 wells. More than one-half of the producers were in

Chautauqua county, but most of the number had only one well which was used for the supply of a single household. The production of this county was 1,270,546,000 cubic feet with a value of $350,904. Erie had the largest output of any county, although its actual production can not be definitely stated. The four counties of Allegany, Cattaraugus, Erie and Genesee together contributed a total of 7,139,920,000 cubic feet valued at $2,095,945, which was a little less than in 1913. The production represented the flow of 1456 wells and did not include the gas consumed in the oil district for pumping operations. Of other counties which contributed, Ontario was the most important with a total of 157,124,000 cubic feet valued at $52,574. Altogether there were fifteen counties represented in the industry.

The business of distributing the output among the cities and communities within the different districts is controlled by a relatively few companies, some of whom are employed also in productive operations. The largest single distributor is the Iroquois Natural Gas Co. of Buffalo with pipe lines to the principal fields in Allegany, Cattaraugus, Erie and Genesee counties. The Alden-Batavia Natural Gas Co. and the Pavilion Natural Gas Co. are important producers and distributors in the Erie-Genesee county district. In Chautauqua county the larger operators include the Frost Gas Co., the Silver Creek Gas & Improvement Co., and the South Shore Natural Gas & Fuel Co. In Allegany and Cattaraugus counties the Gowanda Natural Gas Co., the Empire Gas & Fuel Co. and the Producers Gas Co. have pipe lines. In Ontario county the main producer and distributor is the Ontario Gas Co. Among the smaller companies engaged in the business are the Consumers Natural Gas Co. with wells in the town of Darien, Schuyler county, the Baldwinsville Light & Heat Co. of Baldwinsville, Onondaga county, the Pulaski Gas & Oil Co. of Pulaski, Oswego county, and the Sandy Creek Oil & Gas Co. of Sandy Creek, Oswego county.

The geological occurrence of natural gas in the State has been described in various reports issued by the New York State Museum. The productive gas pools are distributed over portions of sixteen counties, but they are all in the section that lies west of the 76th meridian, which crosses the west end of Oneida lake. Discoveries have been reported from time to time in the eastern part of the State, notably in the sections along the Mohawk river as far east as Albany county; in this region, however, the gas seems to be confined to small pockets which are rapidly depleted.

The most prolific gas pools thus far found are in the sandstones

of the Medina formation, near the top of the latter. This formation outcrops in a belt along the south shore of Lake Ontario and consists mainly of shale with sandstones in the upper part, with an aggregate thickness of about 1200 feet. It extends along the lake shore from the Niagara river to Oswego county, and continues eastward for some distance beyond the limits of this county. The strata have been little disturbed or changed since their uplift. They dip slightly toward the south or southeast, the average inclination being about 50 feet to the mile. The dip together with the rising elevation toward the south soon brings the strata under a considerable cover which increases progressively with the distance from the outcrop. The important gas pools of Erie and Genesee counties occur in the Medina at depths of from 1200 to 1800 feet; those in the southern part of Erie county being the deepest. The lake shore gas belt of Chautauqua county also derives its main supply from the Medina which is encountered at depths of 1900–2300 feet. The deepest explorations have been in northern Cattaraugus county, where gas sands supposedly belonging to the Medina have been encountered at 2500–3300 feet.

Next to the Medina, the most important horizon is in the Chemung sandstones at the top of the Devonic, the same strata that yield the petroleum production of New York. The wells are from 600 to 1800 feet deep and were primarily drilled for oil, but the gas is an important subsidiary product that is utilized in part for pumping the wells. The excess is piped to the communities in the district and as far as Buffalo.

The Trenton limestone affords a small supply of gas which is developed at Pulaski and Sandy Creek, Oswego county, at the east end of Lake Ontario and at Baldwinsville, Onondaga county. At the localities first named the wells are 1200–1500 feet deep and at Baldwinsville 2400 feet.

PETROLEUM

The oil industry, which is confined to a small area in the southwestern part of the State, has not been attended by any notable discoveries or new developments during the past year. The production, however, was of the usual proportions, as in fact it has changed very little within the last quarter of a century. The maintenance of the yield may be said to be the most remarkable feature of the local industry, contrasting in that respect with many fields which have had a much larger initial production. It is largely the result of a policy of conservation and economy that has been pursued by

the producers. There is still undrilled territory within the limits of the productive pools, and the gradual development of this ground with the cleaning and redrilling of old wells suffice to keep the production at a nearly constant level. The economy with which the operations are conducted is indicated by the fact that the average yield is now only one-third of a barrel a day.

The run of oil in 1914 as reported by the pipe-line companies and other shippers amounted to 933,511 barrels. This showed a small increase over the total for 1913 which was 916,873 barrels, and there would have been a still larger gain, doubtless, if the prices had remained at the level which prevailed in the early months. A decline of over $1 a barrel took place during the summer and served to discourage new drilling. The outlook for development work in the current season is not very promising.

The record of field work, as compiled monthly by the Oil City Derrick, showed that 267 wells were drilled last year in New York territory. This was only about one-half the number drilled in 1913 when prices for crude oil rose rapidly in the first months, the actual number drilled in that year having been 512. In 1912 the reports showed 246 new wells. The increment of production from the new wells amounted to 446 barrels, as compared with 810 barrels in 1913 and 278 barrels in 1912. Of the number of wells completed, 17 were dry as compared with 48 in 1913 and 66 in 1912.

The market prices of New York crude oil are based on the quotations of Pennsylvania crude which are the highest in the market. During the first four months of 1914 the quotations remained unchanged at $2.50 a barrel, which level they had reached early in 1913. On this basis there was a very good profit in production and the industry was very active. In May, however, the prices declined abruptly to $1.90, and thereafter fell off gradually month by month until in September they reached $1.45 at which they remained to the close of the year. The causes of the rapid rise and decline seem to be unexplainable from the standpoint of the market situation, as there were no such variations in the prices of the refined products.

Production of petroleum in New York

YEAR	BARRELS	VALUE
1895	912 948	$1 240 468
1896	1 205 220	1 420 653
1897	1 279 155	1 005 736
1898	1 205 250	1 098 284
1899	1 320 909	1 708 926
1900	1 300 925	1 759 501
1901	1 206 618	1 460 000
1902	1 119 730	1 530 852
1903	1 162 978	1 849 135
1904	1 036 179	1 709 770
1905	949 511	1 566 931
1906	1 043 088	1 721 095
1907	1 052 324	1 736 335
1908	1 160 128	2 071 533
1909	1 160 402	1 914 663
1910	1 073 650	1 458 194
1911	955 314	1 251 461
1912	782 661	1 338 350
1913	916 873	2 255 508
1914	933 511	1 773 671

The statistics of production for the last two decades are shown in the accompanying table. The figures for the period 1895-1903 have been taken from the annual volumes of the Mineral Resources and those for the following years compiled from the individual reports rendered by the pipe-line companies and shippers who operate in the State. The list of these companies follows: Columbia Pipe Line Co., Union Pipe Line Co., Fords Brook Pipe Line Co., Buena Vista Oil Co. and Madison Pipe Line Co., of Wellsville; Vacuum Oil Co., Rochester; New York Transit Co., Olean; Emery Pipe Line Co., Allegany Pipe Line Co., Tide Water Pipe Co., Limited, and Kendall Refining Co., of Bradford, Pa.

The oil is found in fine-grained sandstones of dark color belonging to the Chemung formation, at the top of the Devonic system. In Cattaraugus county the productive area embraces about 40 square miles, mostly in Olean, Allegany and Carrolton townships. The pools, of which the principal ones are the Ricebrook, Chipmunk, Allegany and Flatstone, occur at several horizons from 600 to 1800 feet below the surface. The oil district of Allegany county extends across the southern townships of Clarksville, Seneca, Wirt, Bolivar, Alma, Scio and Andover and is divided into several pools that are considered to be more or less independent. The Bolivar, Richburg and Wirt pools have been most productive. The oil is found at depths of from 1400 to 1800 feet. The Andover pool

lies partly in the town of West Union, Steuben county, and is accountable for the production in that section.

The productive wells in the three counties number about 10,500, of which 7500 are in Allegany county, 200 in Steuben and the remainder in Cattaraugus county. All are pumped, using natural gas derived from some of them for power. The average yield is now less than one-third of a barrel a day.

SALT

The salt industry shared in the general decline which characterized most of the business activities last year and reported a considerable falling off in output. The decline was the first serious interruption to progress that the industry has felt in some time, in fact since the panic times of 1907 when there was a temporary but rather serious drop in production. As a whole, however, the conditions were not particularly hard upon the producers, as they would have been if accompanied by a corresponding shrinkage of prices; but the latter seem to have been well maintained according to the averages reported for the values of the different grades.

The statistics for the last two years are summarized in the accompanying tables. The output in 1914 was 10,389,072 barrels against 10,819,521 barrels in the preceding year; showing a decrease of 430,449 barrels or approximately 4 per cent. Converted to a tonnage basis, the product last year was equivalent to 1,454,470 short tons. It was the third largest total that has been reported up to the present.

The classification of the product according to grades recognized in the trade is followed so far as practicable without revealing the individual figures. Rock salt and the salt in brine that is consumed for alkali manufacture appear in the last item of the tables, which includes also small amounts of evaporated salt not specially classified in the returns. Most of the evaporated salt is marketed under the grades of common fine, common coarse, table and dairy, solar and packers salt. Table and dairy salt includes the superior grades of artificially evaporated salt that are specially prepared for the table and for butter and cheese making; it brings the highest market prices. Under common fine are listed the other grades of fine, artificially evaported salt that are not specially prepared. Common coarse represents the coarser product from artificial evaporation. Solar salt is made by evaporation of brine in shallow vats exposed to the sun's heat. The process is employed only by the manufacturers on the old Onondaga Salt Springs Reservation at

Syracuse, and can be carried on of course only in the summer months. The product is used practically for the same purposes as rock salt. Packers salt includes the grade sold to meat packers and fish salters.

Production of salt by grades in 1913

GRADE	BARRELS	VALUE	VALUE A BARREL
Common fine [1]	1 490 957	$583 757	$ .39
Common coarse	111 057	45 942	.45
Table and dairy	1 266 864	789 857	.62
Solar	436 800	131 040	.30
Packers	107 293	51 895	.48
Other grades [2]	7 406 550	1 254 173	.17
Total	10 819 521	$2 856 664	$ .26

[1] Common fine includes a small quantity of common coarse.
[2] Includes rock salt, salt in brine used for alkali manufacture, and small amounts of brine salt for which the uses were not specified in the returns.

Production of salt by grades in 1914

GRADE	BARRELS	VALUE	VALUE A BARREL
Common fine [1]	1 369 071	$543 203	$ .40
Common coarse	162 329	74 545	.46
Table and dairy	1 272 629	820 840	.64
Solar	328 700	90 392	.27
Packers	100 186	50 402	.50
Other grades [2]	7 156 157	1 256 324	.18
Total	10 389 072	$2 835 706	$ .27

[1] Common fine includes a small amount of common coarse.
[2] Includes rock salt, salt in brine used for alkali manufacture, agricultural salt, and small amounts of brine salt for which the uses were not specified in the returns.

The production in recent years has come from a number of localities comprised within the counties of Genesee, Livingston, Onondaga, Schuyler, Tompkins and Wyoming. Altogether the brine salt industry is the larger and includes the following list of manufacturers now active: International Salt Co., with works at Myers and Watkins; Worcester Salt Co., Silver Springs; Eureka Salt Corporation, Saltville; Rock Glen Salt Co., Rock Glen; Remington Salt Co., Ithaca; Watkins Salt Co., Watkins; Genesee Salt Co., Piffard; Le Roy Salt Co., Leroy; and the several makers of solar salt at Syracuse who market their output through the Onondaga Coarse Salt Association of that city. To the list may be

added the Solvay Process Co. which produces a large amount of brine but use it all in soda manufacture. There are two rock salt mines, of which one is owned by the Retsof Mining Co. of Retsof, and the other is worked by the Sterling Salt Co. of Cuylerville.

The salt deposits of the State are very extensive and capable of supporting any demand that may be made upon them. They are found to the south of the outcrop of the Salina formation of which they are a part, in the section from Madison county to Erie county. It is unusual to find them at depths of less than 800-1000 feet, since the portions above that limit have been dissolved away, but they have been penetrated in wells far to the south of the outcrop at depths of 3000 feet and over. New beds are discovered from time to time in course of explorations for oil and gas.

A complete record of the industry is available since 1797 when the first regular operations were started on the Onondaga reservation. The total output from that time down to and including the year 1914 has been 268,011,788 barrels. The annual production for the last 25 years has been as follows:

Production of salt in New York since 1890

YEAR	BARRELS	VALUE
1890	2 532 036	$1 266 018
1891	2 839 544	1 340 036
1892	3 472 073	1 662 816
1893	5 662 074	1 870 084
1894	6 270 588	1 999 146
1895	6 832 331	1 943 398
1896	6 069 040	1 896 681
1897	6 805 854	1 948 759
1898	6 791 798	2 369 323
1899	7 489 105	2 540 426
1900	7 897 071	2 171 418
1901	7 286 320	2 089 834
1902	8 523 389	1 938 539
1903	8 170 648	2 007 807
1904	8 724 768	2 102 748
1905	8 575 649	2 303 067
1906	9 013 993	2 131 650
1907	9 657 543	2 449 178
1908	9 005 311	2 136 736
1909	9 880 618	2 298 652
1910	10 270 273	2 258 292
1911	10 082 656	2 191 485
1912	10 502 214	2 597 260
1913	10 819 521	2 856 664
1914	10 389 072	2 835 706

SAND AND GRAVEL

The production of sand and gravel should be given consideration as one of the branches of the mineral industry. It is carried on in one or more places in practically every county of the State; but only in a few sections has it become really stabilized so as to be conducted on a more or less permanent basis. For that reason a statistical investigation of the industry is attended with considerable difficulty, and the results may be lacking somewhat in accuracy.

Such is the case more especially with the ordinary building sands and gravels which are so widely distributed that in most places they have little or no intrinsic value, the requirements being supplied from deposits in the immediate vicinity at a nominal expense above the cost of handling. In recent years, however, there has been a manifest tendency toward a standardization of these materials where they are to be employed in important structures or engineering works. It has been found that they have a very direct influence upon the quality of the mortar or concrete into which they enter, a fact that has not received so wide appreciation as it should perhaps, outside of the engineering profession. The need for materials that will meet the modern requirements has made necessary more care in the selection, besides preparation oftentimes by sizing or washing. This development is one that promises to place the industry upon a more settled basis than it has had in the past.

Sand also serves a variety of other uses, such as for glass manufacture, for making of molds for casting metals, as an abrasive, and in numerous manufacturing and metallurgical operations. In most of these applications the sands must meet certain definite requirements as to physical condition, mineral or chemical composition, which greatly limit the available sources of supply. Their production necessitates a degree of skill and technic which makes for permanency in the enterprises.

The sand and gravel beds of the State belong mainly to the Pleistocene formations, accumulated as the result of the great ice invasion which moved from north to south and reached as far south as northern New Jersey and Pennsylvania. This ice sheet swept the rocks bare of their former mantle of disintegrated materials and in their place left a covering of transported bowlders, gravels, sands and clays. These materials when deposited directly by the ice as ground moraine are so intermixed as to have little or no industrial value. Such unmodified drift covers a considerable portion of the area, especially in the hilly country, whereas in the

valleys and lowlands it is usually concealed by beds of sorted gravels, sands and clays. These latter were deposited by the waters which issued from the glacier during its retreat. In some of the larger valleys, as those of the Hudson, Champlain and Genesee, as well as in numerous smaller ones, the glacial waters were held imprisoned for a time by dams so that they stood high above the present levels, and the sands and clays were deposited in a series of terraces in great thickness and in well-sorted arrangement.

Beach sands are found on the shores of Long Island and Staten Island and of some of the interior lakes, notably Oneida lake. These are characterized by a degree of uniformity and purity which make them valuable for many purposes. The sands that have been used most extensively for glass making are found on Oneida lake.

Production. The statistics of the sand and gravel industry, as collected from the individual producers, give an approximation of the total business, but it is not claimed that they are complete. The figures for molding sand, however, are complete, as this branch of the industry is conducted on a settled basis which admits of an accurate canvass. The figures of building sand and gravel no doubt underestimate the actual production, perhaps by as much as 15 per cent. The operations are so widely scattered and in many places of so fugitive a nature that they can not all be included in the canvass.

Production of sand and gravel

MATERIAL	1912	1913	1914
Building sand	$1 156 002	$1 102 688	*a*$1 151 521
Molding sand	422 148	449 224	310 727
Fire and core sand	55 910	38 571	23 944
Other sand *b*	75 000	75 000	75 000
Gravel	840 669	918 783	650 895
Total	$2 549 729	$2 584 266	$2 212 087

a Includes filter sand.
b Includes glass sand, filter sand except for 1914, engine sand, polishing sand and core sand.

Building sand. The main uses of this sand are for concrete and mortar. It is produced in about every community of any importance, inasmuch as almost any sandy material which is not too diluted with mud or silt may be employed for some of the purposes for which building sand is used. The more extensive

workings are in the vicinity of New York, Buffalo and Rochester. New York derives its principal supply from the beach sands on the north shore of Long Island, mainly from Nassau county. They are dredged from shallow water and conveyed to market in barges. They are among the best sands of their type, consisting of nearly pure quartz sand, well sorted and fairly coarse. Buffalo is supplied from the beach sands of Lake Erie. Glacial sands, modified by stream action, are the sources of supply in Albany and Rochester and many of the interior towns.

The output of building sand in 1914 was returned as 3,710,796 cubic yards worth $1,151,521, about the same as was reported in the two previous years. The output, however, included some filter sand which previously was listed under another head.

Molding sand. The production of molding sand was 310,727 short tons valued at $310,727, showing a large decrease for the year. The falling off was the result of the depression in the metal trades which curtailed the market. This grade of sand is produced in a single district which includes the section along the Hudson river from Saratoga and Washington counties on the north to Kingston, Ulster county. The sand is a deposit formed in the glacial Lake Albany, that has been sorted by wind action and modified by weathering influences. The main production comes from the terraced lands just north and south of Albany. The industry is represented by a relatively few companies and individuals who maintain continuous operations from year to year. The sand is remarkable for its fine, even grain.

SAND-LIME BRICK

The manufacture of sand-lime brick was carried on last year by three plants, one less than in 1913. The companies represented were the Paragon Plaster Co. of Syracuse, the Buffalo Composite Brick Co. of Buffalo, and the Rochester Composite Brick Co. of Rochester, all of which have been in the business for several years. The Glens Falls Granite Brick Co., the first to erect a plant in the State for commercial production, did not operate during the past season.

The production for the year amounted to 17,696,000, valued at $111,326, against 22,225,000, valued at $143,345 in 1913. The average selling price was $6.29 a thousand as compared with $6.40 in the preceding year.

Although the industry has not shown the growth that was earlier

predicted by those interested in its development, it has established a recognized place for its products among standard building materials. It was handicapped for a time by the sales of inferior grades of brick, made in plants which were not properly equipped for turning out a first-class product. Some of these brick had a mortar bond and should not have been classed as sand-lime brick. It can be definitely stated that such grades are no longer manufactured, and that the present output consists of a superior grade with a calcium silicate bond.

Production of sand-lime brick

YEAR	QUANTITY	VALUE	VALUE A THOUSAND	OPERATING PLANTS
1906	17 080 000	$122 340	$7 16	7
1907	16 610 000	109 677	6 60	9
1908	8 239 000	55 688	6 44	6
1909	12 683 000	81 693	6 31	6
1910	14 053 000	82 619	5 88	6
1911	15 178 000	92 064	6 05	5
1912	21 231 000	133 736	6 30	5
1913	22 225 000	143 345	6 40	4
1914	17 696 000	111 326	6 29	3

STONE

The products of the stone quarries form a large item in the total mineral production of the State. The last few years have witnessed, however, some notable changes in the relative importance of the different branches of the stone industry. The use of cement and terra cotta in architectural work has curtailed the demand for cut stone, so that this branch no longer occupies the prominent place that it once had. Similarly the market for flagstone and curbstone has fallen off, especially for flagstone, as a result of the favor shown for cement construction. On the other hand there has been a tremendous development of the crushed stone industry, which has practically counterbalanced the declines in the other departments. Altogether the changes that have taken place have meant a loss industrially, since the preparation of crushed stone requires a minimum of labor of the unskilled sort, while the cut stone business once gave employment to large numbers of highly trained workmen.

The statistics of stone production which have been supplied by the quarry operators throughout the State indicate that the year

1914 was a period of great depression for all branches of the industry. As compared with the conditions in the preceding year, which may be described as about normal, the past season represented a reaction of extreme character such as has not been experienced in a long time. The actual decline of output was 17 per cent, from a value of $6,763,054 in 1913 to $5,741,137 last year, but these figures scarcely indicate the full extent of the depression since the worst stage was not reached until the late months. Many quarries closed down in the late summer and fall and have not since resumed work. There is little expectation that the trade will show much improvement during the current season.

The granite quarries reported a slight gain in the value of their output which was the result of sales of cut stone for buildings and a small gain in crushed stone. The other products, inclusive of monumental granite, showed a decline.

Limestone, as heretofore, constituted somewhat more than one-half of the total output in value, although there was a very large decrease in the aggregate. The falling off was distributed over all the various branches, including building stone, crushed stone, lime and flux.

The production of the marble quarries showed little change. A small increase in building stone was counterbalanced by a diminished output of monumental stock.

The sandstone quarries were worked on a much diminished scale, the decline being greater in this industry than in any other of the stone trades. The depression was felt by both the bluestone quarries and those of ordinary sandstone, and their production was smaller than in any previous year for a long time.

The trap quarries in the palisades region contributed a reduced output of crushed stone.

The production of the different kinds of stone for the last three years is shown in the accompanying tables.

Production of stone in 1912

VARIETY	BUILDING STONE	MONUMENTAL	CURBING AND FLAGGING	CRUSHED STONE	ALL OTHER	TOTAL VALUE
Granite........	$65 487	$19 130	*a*	$49 307	$68 172	$202 096
Limestone. ...	108 581	....	$5 481	2 176 368	1 220 015	3 510 445
Marble........	155 411	84 511	....	....	1 925	241 847
Sandstone.....	363 055	....	615 846	45 301	256 541	1 280 743
Trap..........	....	....	....	483 863	....	483 863
Total.....	$692 534	$103 641	$621 327	$2 754 839	$1 546 653	$5 718 994

a Included under "All other."

Production of stone in 1913

VARIETY	BUILDING STONE	MONUMENTAL	CURBING AND FLAGGING	CRUSHED STONE	ALL OTHER	TOTAL VALUE
Granite.......	$45 911	$17 013	*a*	$236 650	$36 068	$335 642
Limestone.....	101 198	....	$6 546	2 386 632	1 358 302	3 852 678
Marble........	127 556	81 330	....	....	43 406	252 292
Sandstone.....	285 645	....	682 984	46 267	306 376	1 321 272
Trap..........	....	....	....	1 001 170	....	1 001 170
Total.....	$560 310	$98 343	$689 530	$3 670 719	$1 744 152	$6 763 054

a Included under "All other."

Production of stone in 1914

VARIETY	BUILDING STONE	MONUMENTAL	CURBING AND FLAGGING	CRUSHED STONE	ALL OTHER	TOTAL VALUE
Granite.......	$79 903	$10 952	....	$259 750	$16 637	$367 242
Limestone.....	81 409	....	$3 877	2 156 503	1 074 274	3 316 063
Marble........	142 223	70 797	....	8 000	9 222	230 242
Sandstone.....	217 508	....	490 222	36 143	313 117	1 056 990
Trap..........	....	....	....	770 660	....	770 600
Total.....	$521 043	$81 749	$494 099	$3 231 056	$1 413 250	$5 741 137

GRANITE

Granite is both a specific and a general term. When used in the restricted scientific sense it means an igneous rock of thoroughly crystalline character in which the chief constituents are feldspar, quartz and mica. Such a rock has a massive appearance; that is, the constituents are uniformly distributed in every direction, and owing to the predominance of the feldspar and quartz the color is rather light, commonly gray or pink. As a variation to the uniform distribution of the minerals, the latter may develop a plane parallel arrangement through the influence of compression when the mass was still deeply buried in the earth's crust. A granite with this parallel or foliated texture is known as a granite gneiss.

The commercial definition of granite is much broader than that given and includes almost any of the crystalline silicate rocks (usually igneous) that possess the requisite physical qualities for use as architectural or monumental stone. In most cases the commercial product is actually a granite in the true sense, but not infrequently it may be a syenite which lacks quartz, or a diorite consisting of plagioclase, feldspar and hornblende, or anorthosite which contains little else than basic plagioclase feldspar. So-called black granites are mainly gabbros and diabases with a large proportion of the iron compounds pyroxene, hornblende and magnetite.

The broader usage will be followed in the present classification, as all the above-named rocks are quarried in this State. The only silicate rock not included under granite is diabase or trap which, on account of the special features surrounding its production and uses, is classified by itself.

Granites and the related igneous types are restricted to two well-defined areas in New York — the Adirondacks in the north and the Highlands in the southeast. Some account of the principal quarries in the two areas has been given in the issue of this report for the year 1911.

The production of granite in the last three years is given in the table herewith. The figures represent the commercial value of the output of all the quarries, with the exception of those operated by contractors on road improvement work, for which it is difficult to compile any reliable figures. The total value of the granite quarried in 1914 was $367,242, as compared with $335,642 in 1913. Gains in building and crushed stone were reported but decreases in the other kinds.

Production of granite

VARIETY	1912	1913	1914
Building	$65 487	$45 911	$79 903
Monumental	19 130	17 013	10 952
Crushed stone	49 307	236 650	259 750
Rubble, riprap	27 861	9 722	....
Other kinds	40 311	26 346	16 637
Total	$202 096	$335 642	$367 242

LIMESTONE

The stone classified under the heading of limestone consists for the most part of the common grades of limestone and dolomite, such as are characterized by a compact granular or finely crystalline texture and are lacking in ornamental qualities.

A smaller part is represented by crystalline limestone and by the waste products of marble quarrying which are sometimes employed for crushed stone, lime-making or flux. Limestone used for the manufacture of portland and natural cement is, however, excluded from the tabulations so as to avoid any duplications of the statistics.

Limestones have a wide distribution in the State, the only region which is not well supplied being the southern part where the prevailing formations are sandstones of Devonic age. The microcrystalline varieties occur in regular stratified order in the Cambric, Lower Siluric, Upper Siluric and Devonic systems. In most sections they occupy considerable belts and have been little disturbed from their original horizontal position. On the borders of the Adirondacks and in the metamorphosed Hudson river region, however, they have been more or less broken up by faulting and erosion and in places have a very patchy distribution.

The Cambric limestones are found in isolated areas on the east, south and west of the Adirondacks. They are usually impure, representing a transition phase between the Potsdam sandstones below and the high calcium limestones above. The lower beds of the Beekmantown formation as originally defined are now known to belong to the Cambric system. The Little Falls dolomite is perhaps the most prominent member of the Cambric limestones and is extensively developed in the Mohawk valley with quarries at Little

Falls, Amsterdam, and other places. It is a rather heavily bedded stone of grayish color, suitable more especially for building purposes. In Saratoga county the Hoyt limestone is in part the equivalent of the Little Falls dolomite; it has been quarried for building stone just west of Saratoga Springs. On the west side of the Adirondacks the Theresa limestone is described by Cushing as a sandy dolomite which may in part belong to the Cambric system. It is comparatively thin and has no importance for quarry purposes.

The Beekmantown limestone, whi h is now taken as including the middle and upper beds of that series as earlier defined, is mostly restricted to the Champlain valley. It occurs on the New York shore in rather small areas, usually down-faulted blocks, that are the remnants of a once continuous belt. It is also represented doubtless in the basal portion of the limestone area that extends across Washington and Warren counties. The only place where it has been extensively quarried is at Port Henry where the purer layers have been worked for flux. In the Lake Champlain region it is a bluish or grayish magnesian limestone occurring in layers from a few inches to several feet thick.

The Chazy limestone is found in the same region as the Beekmantown in discontinuous areas along the eastern Adirondacks from Saratoga county north to the Canadian boundary. It attains its maximum thickness in eastern and northeastern Clinton county, and has been quarried around Plattsburg, Chazy and on Valcour island. The Chazy is the earliest representative of the Paleozoic formations characterized by a fairly uniform high calcium content; it analyzes 95 per cent or more of calcium carbonate. It has a grayish color and finely crystalline texture. The fossiliferous beds afford attractive polished material which is sold as "Lepanto" marble. It is used also for lime and furna e flux. There are old quarries on Willsboro point, Essex county. On the west side of the Adirondacks the Pamelia limestone, described in the areal reports of that section, belongs to the Chazy series. It covers a considerable area in Jefferson county between Leraysville and Clayton, and has been rather extensively quarried for building stone and lime, though of subordinate importance to the Trenton limestones of that section.

In the Mohawkian or Trenton group are included the Lowville (Birdseye), Black River and Trenton limestones which have a wide distribution and collectively rank among the very important quarry materials of the State. They are represented in the Champlain valley but are specially prominent on the Vermont side; from

the latter area a belt extends southwest across northern Washington county to Glens Falls in Warren county and is continued into Saratoga county. Another belt begins in the Mohawk valley near Little Falls and extends northwesterly with gradually increasing width across Oneida, Lewis and Jefferson counties to the St Lawrence river. There are isolated areas of Trenton limestone in the Hudson valley south of Albany. The limestones vary in composition and physical character according to locality and geologic position. They are often highly fossiliferous. In the northern section they are mostly gray to nearly black in color, contain little magnesia and run as high as 97 or 98 per cent calcium carbonate. The lower part of the group is heavily bedded and well adapted for building stone; the upper beds commonly contain more or less shale. They are used for various purposes including building and ornamental stone, crushed stone, lime, portland cement and flux. In the Champlain valley quarries are found near Plattsburg, Larabee's Point and Crown Point; in Washington county at Smith's Basin; in Warren county at Glens Falls where there are extensive quarries that supply material for building purposes, portland cement and lime. The well-known black marble from Glens Falls is taken from the Trenton. Numerous quarries have been opened in Herkimer, Oneida, Lewis and Jefferson counties. The output of the last named county is specially important, including limestone for building and road construction and lime for manufacture of calcium carbide. The principal quarries in Jefferson county are at Chaumont.

The next assemblage of limestones in the order of stratigraphic occurrence includes the Clinton, Lockport and Guelph members of the Niagara group. The Clinton limestone has a variable importance in the belt of Clinton strata that extends from Otsego county a little south of the Mohawk river across the central and western parts of the State on the line of Oneida lake and Rochester to the Niagara river. East of Rochester the limestone is relatively thin, usually shaly and split up into several layers, but on the west end in Niagara county it becomes the predominant member and has a more uniform character. Large quarries have been opened recently at Pekin, Niagara county, for the supply of flux to the blast furnaces of the Lackawanna Steel Co., at Buffalo. The upper beds of bluish gray fossiliferous limestone from 10 to 12 feet thick are the purest and analyze from 90 to 95 per cent. calcium carbonate. The Lockport is a magnesian limestone, in places a typical dolomite, and is rather siliceous in the lower part. It outcrops in a continuous belt,

several miles wide, from Niagara Falls east to Onondaga county and then with diminishing width across Madison county. The upper layers are rather heavy and yield material suitable for building purposes, road metal and lime. There are quarries around Niagara Falls, Lockport and Rochester. It is worked to some extent in Wayne, Onondaga and Madison counties. The Guelph, also a dolomite, occupies a limited area in Monroe and Orleans counties and is worked near Rochester.

The Cayugan group includes among its members the Cobleskill, Rondout and Manlius limestones, which are economically important. They have furnished large quantities of material for the manufacture of natural cement, being the source of the cement rock in the Rosendale district and in Schoharie and Onondaga counties. The cement rock of Erie county is found in the Salina formation. The Manlius limestone is used for portland cement in the eastern part of the State.

At the base of the Devonic system appears the Helderbergian group which is very important for its calcareous strata. Limestones of this age are strongly developed along the Hudson river in Albany, Columbia, Greene and Ulster counties. The Coeymans or lower Pentamerus and the Becraft or upper Pentamerus limestones afford material for building, road metal, lime and portland cement. The limestone for the portland cement works at Hudson and Greenport is obtained from Becraft mountain, an isolated area of limestones belonging to the Manlius, Helderbergian and Onondaga formations. The works at Howes Cave use both the Manlius and Coeymans limestones. Extensive quarries are located also at Catskill, Rondout and South Bethlehem.

The Onondaga limestone, separated from the preceding by the Oriskany sandstone, has a very wide distribution, outcropping almost continuously from Buffalo, Erie county, eastward to Oneida county and then southeasterly into Albany county, where the belt curves to the south and continues through Greene, Ulster and Orange counties to the Delaware river. It is in most places a bluish gray, massive limestone with layers and disseminated nodules of chert. The chert is usually more abundant in the upper beds. The limestone finds use as building stone and the less siliceous materials also, for lime-making. Quarries have been opened at Kingston, Split Rock (near Syracuse), Auburn, Waterloo, Seneca Falls, Le Roy, Buffalo and other places.

The Tully is the uppermost of the important limestone formations and likewise the most southerly one represented in the central part

of the State. Its line of outcrop extends from Ontario to Madison county, intersecting most of the Finger lakes. Its thickness is not over 10 feet, and on that account can not be worked to advantage except under most favorable conditions of exposure. For building stone it is quarried only locally and to a very limited extent. It finds its principal use in portland cement manufacture, being employed for that purpose by the Cayuga Lake Cement Co., in its works at Portland Point, Tompkins county.

Marl is a useful substitute for the hard limestone for some purposes and is rather extensively developed in the central and western parts of the State. It is found particularly in swampy tracts and old lake basins associated with clay and peat. In the Cowaselon swamp near Canastota the marl underlies several thousand acres and is said to be 30 feet thick. The Montezuma marshes in Cayuga and Seneca counties contain a large deposit which at Montezuma is 14 feet thick. In Steuben county the marls at Arkport and Dansville have been employed for lime-making. Until recently marls have been used extensively for portland cement and plants were operated at one time in the marl beds near Warner and Jordan, Onondaga county; at Montezuma, Cayuga county; Wayland, Steuben county; and Caledonia, Livingston county. Their principal use at present is for agricultural and chemical purposes.

Production. As already noted in a previous paragraph, limestone ranks first in importance among the quarry materials of the State. The value of the output is larger than that of all other kinds together, and is gaining in relative importance year by year. Its main use is for crushed stone for concrete and roadwork; most of the stratified formations contain limestones that are adapted to that purpose. It is also employed as building stone, though not so extensively as formerly, and considerable quantities are consumed in metallurgy and chemical manufacturing. Of late quite a demand for finely ground limestone has developed in connection with agriculture. Lime manufacture still holds a prominent place in the industry.

The production of limestone, after showing a steady gain for several years, fell off markedly in 1914 and aggregated only $3,316,063 as compared with $3,852,678 in 1913. The decline amounted to about 14 per cent. The figures for the last three years distributed according to the various uses are shown herewith.

Production of limestone

MATERIAL	1912	1913	1914
Crushed stone	$2 176 368	$2 386 632	$2 156 503
Lime made	452 002	486 908	370 377
Building stone	108 581	101 198	81 409
Furnace flux	542 154	575 102	446 877
Rubble, riprap	10 696	26 006	6 055
Flagging, curbing	5 481	6 546	3 877
Miscellaneous	215 163	270 286	250 965
Total	$3 510 445	$3 852 678	$3 316 063

Altogether 91 quarries reported an output, as compared with 104 in 1913. There were 29 counties represented in the industry. There were no new quarries of any importance opened during the year.

Erie county outranks all others in importance in this industry; the value of the limestone quarried in the county last year amounted to $704,865. The products are chiefly furnace flux, crushed stone and building stone. The principal quarries are at North Buffalo, Clarence and Akron.

Onondaga county is the second largest producer, having an output last year valued at $385,335. Crushed stone is a large item in its industry, and most of the remainder consists of limestone quarried by the Solvay Process Co. for use as a reagent in alkali manufacture.

The other counties reporting values of over $100,000 in 1913 were Dutchess, Ulster, Niagara, Rockland, Genesee, Warren, Schoharie, Clinton and Albany counties, named in the order of their output.

Crushed stone. Limestone is crushed for road metal, railroad ballast and for concrete. The larger quarries supplying this material are in Erie, Genesee, Onondaga, Dutchess, Ulster, Rockland and Westchester counties. The fines from some of the quarries are sold for agricultural use, the sales being entered under "other uses." The value of the crushed stone for 1914 showed a decrease due to the smaller demand in the building trade, and totaled $2,156,503, against $2,386,632 in the preceding year. The total does not include stone crushed by contractors on the highway system, but the value of such stone is relatively small. The actual

quantity of stone produced by the crushing plants was 3,306,325 cubic yards against 3,945,543 cubic yards in 1913.

Lime. The value of the lime made for market last year was $370,377, as compared with $486,908 in 1913. In quantity it amounted to 82,944 short tons, against 110,083 short tons in 1912. The decrease was brought about mainly by the shutting down of two of the larger plants, one in Lewis and another in Genesee counties. Although less lime is used in the building trade than formerly, the loss has been partially compensated by the growth of demand in the agricultural industry. The principal plants are in Warren, Washington, Clinton, Fulton, Madison and Dutchess counties.

Building stone. The production of building stone has fallen off year by year, so that a further decrease in 1914 was not unexpected. The decline of 20 per cent, however, was larger than usual and reduced the output so that it represented but a fraction of the former total. The returns showed the value of the building stone to be $81,409 as compared with $101,198 in 1913. This represents less than one-third of the output ten years ago.

The diminished demand for cut stone is a feature that has manifested itself in the building trades throughout the country. It is due largely to change in the methods of building construction, particularly in the use of steel, concrete and tile for large structures. The principal quarries of building stone are in Erie, Cayuga, Onondaga and Montgomery counties.

Furnace flux. The metallurgical establishments, especially the iron and steel plants, consume a large quantity of fluxing limestone which is obtained mostly from local resources. For this purpose calcium limestone is mostly in demand, and it is required to be nearly free of siliceous and aluminous impurities. The principal flux quarries are in the Onondaga limestone of Erie and Genesee counties, the Clinton limestone of Niagara county, the Precambric limestones or marbles of the Adirondacks and the Chazy limestone of the Champlain valley. The limestones in these sections ordinarily carry from 90 to 95 per cent of calcium carbonate. The production of flux in 1914 was valued at $446,877, representing a total of 795,538 net tons, as compared with $575,102 and 1,052,519 tons in 1913. Niagara and Erie counties, which supply the iron and steel works around Buffalo, reported the largest quantities.

Agricultural lime. The use of lime on soils has become in the last few years an important factor in the quarry industry. The quantity sold for the purpose is not given separately in the statisti-

cal tables, for the reason that many of the quarry companies do not themselves know the amount of the product that is thus used. Some of the material disposed of for agricultural use is really a by-product of which little account is taken, as in the case of the fines and dust of the crushing plants which are sometimes marketed, and also the inferior grades of quicklime. There are a number of quarries, however, that make a specialty of this trade, selling all or a large part of their product for agricultural use. It is estimated that fully 100,000 tons of limestone were thus marketed by the quarries, and the amount may have been considerably more.

The possibilities of the trade have received much attention in the last few years, and quarry lands favorably situated with respect to the markets have been in request. Inasmuch as the material must be delivered to the consumer at a low cost to make it economically available, the tendency is to develop local sources of supply in so far as these are available.

The resources in limestone suitable for agricultural use are quite widespread, but they are not always within easy reach of markets. They are most abundant in the northern section particularly on the borders of the Adirondacks and the adjacent regions to the south, where they occur in the Precambric and early Paleozoic formations. The crystalline limestones or marbles of St Lawrence, Jefferson and Lewis counties and the Trenton and Chazy stratified limestones of the Champlain and Mohawk valleys are among the best high calcium rocks. Some agronomists hold the view that magnesium above a small amount is detrimental, while others are of the opinion that it may perform a useful function or at least have no harmful effect if not existing in a proportion of more than about one-half that of lime. Supplies of magnesian limestones occur in Highlands and Taconic sections and also in the central and western counties. The southern tiers of counties on the Pennsylvania border are devoid of carbonate rocks.

Production of limestone by counties in 1913

COUNTY	CRUSHED STONE	LIME MADE	FURNACE FLUX	BUILDING STONE	OTHER USES	TOTAL
Albany	$141 583	....	....	....	....	$141 583
Cayuga	30 455	....	....	$12 552	$74	43 081
Clinton	42 861	$62 073	$17 810	450	1 255	124 449
Dutchess	433 117	18 392	....	....	....	451 509
Erie	514 619	....	251 011	56 239	10 710	832 579
Genesee	208 881	15 000	60 860	700	3 500	288 941
Greene	2 300	....	....	....	350	2 650
Herkimer	1 800	....	....	....	....	1 800
Jefferson	8 170	58 230	1 000	....	16 400	83 800
Lewis	11 971	43 602	....	114	4 471	60 158
Madison	43 365	41 571	1 380	685	1 950	88 951
Monroe	30 695	7 650	....	5 199	....	43 544
Montgomery	30 949	....	....	4 995	1 361	39 305
Niagara	22 396	....	215 498	2 810	236	240 940
Onondaga	282 425	....	....	9 581	209 500	501 506
St Lawrence	13 407	3 162	18 915	810	453	36 747
Schoharie	86 742	....	400	431	26 438	114 011
Ulster	76 071	16 010	....	....	....	92 081
Warren	32 466	154 618	....	5 435	26 082	218 601
Washington	1 500	43 000	....	250	....	44 750
Other counties	370 859	23 600	8 228	947	58	403 692
Total	$2 386 632	$486 908	$575 102	$101 198	$302 838	$3 852 678

Production of limestone by counties in 1914

COUNTY	CRUSHED STONE	LIME MADE	FURNACE FLUX	BUILDING STONE	OTHER USES	TOTAL
Albany	$101 022	....	....	....	....	$101 022
Cayuga	49 860	....	....	$14 124	....	63 984
Clinton	14 917	$61 462	$12 423	3 500	$10 616	102 918
Dutchess	322 970	26 050	....	....	....	349 020
Erie	478 127	....	177 764	44 939	4 035	704 865
Genesee	156 302	....	40 000	600	....	196 902
Greene	4 039	....	....	....	....	4 039
Herkimer	700	....	....	....	....	700
Jefferson	10 992	11 600	....	....	2 700	25 292
Lewis	3 700	....	....	217	....	3 917
Madison	43 498	55 896	....	....	....	99 394
Monroe	20 027	4 898	....	1 021	....	25 946
Montgomery	6 400	....	....	4 576	744	11 720
Niagara	6 780	....	190 334	300	5 700	203 114
Oneida	74 741	....	....	....	....	74 741
Onondaga	148 106	....	....	6 193	231 036	385 335
St Lawrence	3 937	4 500	22 172	2 440	274	33 323
Schoharie	108 241	....	....	416	....	108 657
Ulster	208 720	7 740	....	....	....	216 460
Warren	18 406	129 281	....	1 708	5 343	154 738
Washington	....	40 000	....	1 000	....	41 000
Other counties	375 018	28 950	4 184	375	449	408 976
Total	$2 156 503	$370 377	$446 877	$81 409	$260 897	$3 316 063

MARBLE

Marble, in the commercial sense, like granite, includes a variety of rocks that lend themselves to building or decorative uses. Most commonly, the name signifies a crystalline aggregate of calcite or dolomite, as distinguished from ordinary limestones which at best are of indistinctly crystalline nature. At the same time it implies the feature of attractiveness by reason of color and the ability to take a lustrous polish. Rocks possessing all these features are marbles in the strict sense to which the name may be applied without qualification. Some compact or granular limestones that lack the elements of thorough crystallinity make, however, a handsome appearance when polished, and such are commercially classed as marbles. Fossil marbles, black marbles, and a few other kinds are commonly of the noncrystalline type. Serpentine marble, or verde antique, is made up for the most part of the mineral serpentine, a silicate of magnesium and iron, and is therefore not related to the varieties already described. Ophitic limestone, or ophicalcite, is a crystalline limestone or dolomite carrying grains and nodules of serpentine scattered more or less evenly through its mass. Its ornamental quality lies in the speckled or mottled pattern and the sharp contrast between the clear white mass and the greenish serpentine inclusions.

Marbles belonging to those various types find representation in the geologic formations of the State and are quarried on a commercial scale or have been so quarried in the past.

The true or crystalline varieties are limited in occurrence to the metamorphic areas of the Adirondacks and southeastern New York. They are of early geologic age, antedating the period of crustal disturbance and metamorphism which in the Adirondacks was brought to a close practically before Cambric time and which in southeastern New York was completed in the Paleozoic. This thoroughly crystalline character is in fact a development of the strong compression accompanied by heat to which they have been subjected; having been originally, no doubt, ordinary granular or fossiliferous limestones similar to those so plentifully represented in the undisturbed formations outside the regions.

The crystalline limestones of the Adirondacks are most abundant on the western border in Jefferson, Lewis and St Lawrence counties where they occur in belts up to 4 or 5 miles wide and several times as long, interfolded and more or less intermixed with sedimentary gneisses, schists and quartzites. They are found in smaller and more irregularly banded areas in Warren and Essex counties on the

eastern side, but have little importance elsewhere. The ophitic limestones that have been quarried at different times belong to the same series. The marbles of the Adirondacks comprise both the calcite class with very little magnesia and the dolomite class containing high percentages of magnesia. No definite relation is apparent in regard to the occurrence of the two and both may be found in the same area and in close association.

The southeastern New York marbles occur in belts which follow the north-south valleys, east of the Hudson, from Manhattan island into Westchester, Dutchess and Columbia counties. They range from very coarsely crystalline to finely crystalline rocks, are prevailingly white in color and belong to the dolomite class. They are interfolded with schists and quartzites, the whole series having steep dips like those of strongly compressed strata. The geologic age of the southern belts is probably Precambric, but on the north and east within range of the Taconic disturbance, they may belong to the early Paleozoic.

Bodies of practically pure serpentine of considerable extent are found on Staten Island and in Westchester county near Rye; they represent intrusions of basic igneous rocks whose minerals, chiefly pyroxene and olivine, have subsequently changed to serpentine. They are not important for quarry purposes, owing to the frequency of fissures and joints and the rather somber color of the exposed part of the masses.

The microcrystalline or subcrystalline limestones that are sometimes sold as marbles include members of the regularly bedded unmetamorphosed Paleozoic limestones, which locally show qualities of color and polish that make them desirable for decorative purposes. They range from dense granular varieties to those having a more or less well-developed crystalline texture and are often fossiliferous. Inasmuch as they have never been subjected to regional compression or been buried in the earth deep enough to become heated, the crystalline texture, when present, may be ascribed to the work of ground waters. These circulate through the mass, taking the carbonates of lime and magnesia into solution, and redeposit them in crystalline form. Originally, the limestones were accumulations of lime-secreting fossils or granular precipitates, for the most part of marine origin. Some of the localities where these unmetamorphic marbles occur are on the west shore of Lake Champlain, around Plattsburg and Chazy (Chazy limestone), Glens Falls (Trenton limestone) and Becraft and Catskill (Becraft limestone).

Production. Building and other kinds of marble to the value of $230,242 was quarried in 1914, showing a slight decrease of production as compared with the preceding year. The active quarries were situated in Clinton, Warren, St Lawrence, Dutchess and Westchester counties. Most of the building marble came from the quarries of the South Dover Marble Co. at Wingdale, Dutchess county. The quarries at Gouverneur, including those of the St Lawrence, Northern New York and Gouverneur companies, supplied the monumental stock. Black and "shell" marble for decorative work were also quarried, the former by Finch, Pruyn & Co. of Glens Falls and the latter by the Vermont Marble Co., of Proctor, Vt.

Production of marble

VARIETY	1912	1913	1914
Building marble	$155 411	$127 556	$142 223
Monumental	84 511	81 330	70 797
Other kinds	1 925	43 406	17 222
Total	$241 847	$252 292	$230 242

SANDSTONE

Under sandstones are included the sedimentary rocks which consist essentially of quartz grains held together by some cementing substance. Among the varieties distinguished by textural features are sandstones proper, conglomerates, grits and quartzites.

Of the sedimentary rocks which occur in the State, sandstone has the largest areal distribution, while in economic importance it ranks second only to limestone. Nearly all the recognized stratigraphic divisions above the Archean contain sandstone at one or more horizons. The kinds chiefly quarried are the Potsdam, Hudson River, Medina and Devonic sandstones. A few quarries have been opened also in the Shawangunk conglomerate and the Clinton and Triassic sandstones.

The Potsdam of the Upper Cambric is the lowest and earliest in age of the sandstones that have a fairly wide distribution and are utilized for building purposes. The most extensive outcrops are along the northern and northwestern borders of the Adirondacks, in Clinton, Franklin, St Lawrence and Jefferson counties. Other exposures of smaller extent are found in the Lake Champlain valley

and on the southeastern edge of the Adirondack region. These latter areas represent the remnants of a on e continuous belt that has been broken up by folding, faulting and erosion. The Potsdam sandstone has in many places the character of a quartzite, consisting of quartz grains cemented by a secondary deposition of quartz, and then is a very hard, tough and durable stone. The quartzite from St Lawrence county has sustained a crushing test of more than 42,000 pounds to the square inch. The color varies from deep red to pink and white. The principal quarries are near Potsdam and Redwood, St Lawrence county, and Malone and Burke, Franklin county. Besides building stone, which is the chief product, there is some flagstone sold, mainly by the quarries at Burke, for shipment to Montreal.

The so-called Hudson river group is essentially a group of sandstones, shales, slates and conglomerates, ranging in age from the Trenton to the Lorraine, but which have not been sufficiently studied to permit the actual delimitation of the various members on the map. The group is exposed in a wide belt along the Hudson from Glens Falls southward into Orange county and also in the Mohawk valleys as far west as Rome. The sandstone beds are usually fine-grained, of grayish color and rather thinly bedded. Over wide stretches they provide practically the only resource in constructional stone and consequently they have been quarried at a great number of places to supply the local needs for building and foundation work. Some of the stone is crushed for road metal and concrete.

The Medina sandstone is found along the southern shore of Lake Ontario from the Niagara river east to Oswego county: in entral New York it is represented by a coarse conglomeratic phase called the Oneida conglomerate. As developed in the western part of of the State, where it is principally quarried, it is hard fine-grained sandstone of white, pink and variegated color. The pink variety is specially quarried for building stone and has an excellent reputation. Many of the larger cities of the country and most of the important towns and cities of the State contain examples of its architectural use. The large quarries are situated in Orleans county, near Albion, Holley and Medina, along the line of the Erie canal, but there are others at Lockport and Lewiston, in Niagara county and at Brockport and Rochester in Monroe county. The Medina sandstone also finds extensive applications for curbing and flagging and for paving blocks. It is employed more extensively for the latter purpose than any other stone quarried in the State.

The Shawangunk conglomerate is more widely known for its use in millstones than for constructional purposes. It outcrops along Shawangunk mountain in Ulster county and southwesterly into New Jersey, with an outlier near Cornwall, Orange county. The quarries near Otisville have supplied considerable quantities of stone for abutments and rough masonry.

The Clinton sandstone is mainly developed in central New York, being absent from the Clinton belt in the western part of the State. It forms ledges of considerable extent on the south side of the Mohawk valley from Ilion to Utica and beyond. It consists of reddish brown and gray sandstones, of medium texture and hardness. The stone has been used for foundations and building in Uti a and other places in the vicinity.

Of the Devonic formations which cover about one-third the whole area of the State, the Hamilton, Portage, Chemung and Catskill contain important sandstone members serviceable for quarry operations. These sandstones are popularly known as bluestones, a name first applied in Ulster county where they are distinguished by a bluish gray color. They are for the most part fine-grained, evenly bedded, bluish or gray sandstones, often showing a pronounced tendency to split along planes parallel to the bedding so as to yield smooth, thin slabs. For that reason they are extensively used for flag and curbstone, and a large industry is based on the quarrying of these materials for sale in the eastern cities. Most flagstone is produced in the region along the Hudson and Delaware rivers, where there are convenient shipping facilities to New York, Philadelphia and other large cities. The Hudson River district includes Albany, Greene and Ulster counties, but the quarries are mainly situated in the area that includes southern Greene and northern Ulster, with Catskill, Saugerties and Kingston as the chief shipping points. The Delaware River district includes Sullivan, Delaware and Broome counties; the shipping stations are along the Erie and Ontario and Western railroads. The sandstone of this section ranges from Hamilton to Catskill age. In the area to the west the quarries are confined to the Portage and Chemung groups, with the most important ones in the Portage. There are large, well-quipped quarries near Norwich, Chenango county, and Warsaw, Wyoming county, which produce building stone for the general market. Numerous small quarries are found in Otsego, Chemung, Tompkins, Tioga, Schuyler, Steuben, Yates, Allegany, Cattaraugus and Chautauqua counties.

Production of sandstone. Sandstone, by reason of its adaptability and its wide distribution, is extensively quarried in the State, ranking next to limestone in commercial importance. The larger part of the output is employed in street work in the form of curbstone, flagstone and paving blocks, but an important quantity is also used as building stone. It finds very little application as crushed stone on account of its platy fracture.

The Devonic sandstones, which are collectively known as bluestone, are more widely quarried than the other kind; this production is carried on throughout the southern part of the State by a large number of individuals and companies. With few exceptions, the quarries are small, giving employment to only two or three workmen each and having very little in the way of mechanical equipment. Such small enterprises are particularly characteristic of the Hudson River and Delaware River regions where much of the flagstone and curbstone is produced. Many of the quarries are worked intermittently by farmers in the off season of their usual occupation. The stone is hauled down the hillside to the railroad sidings or the river docks where it is purchased by middlemen who ship it to the eastern markets. The stone from the Hudson River district is mainly shipped by barges from Kingston and Saugerties. In the interior it is shipped by rail. A statistical canvass of such small enterprises is a matter of great difficulty and is likely to afford very unreliable results. Consequently, it has been the practice in the compilation of this report to secure the information so far as possible from dealers who purchase the stone for shipment to the large wholesalers and consumers in the cities.

The production of sandstone during the last two years is shown in the accompanying tables which give its distribution also among the leading districts.

The combined value of all the sandstone quarried in 1914 was $1,056,990, against $1,321,272 in 1913. The total is exclusive of any sandstone quarried by contractors for use on the State highway system, for which it is impossible to assign any accurate value.

Of the value given, a little more than one-half was returned by the quarry companies operating in the bluestone districts, in exact figures $546,314. This indicated a marked decline of activity in these districts as compared with the preceding year when the output was valued at $753,510. There has been a falling off in the bluestone industry for several years back, owing to the increasing use of cement and concrete in street work. The value of the flagstone and curbstone made from blue stone was $337,488 against

$503,607 in 1913. At the same time the output of building stone amounted to $191,239 against $227,645 in 1913.

Sandstone other than bluestone represented a value of $510,676 as compared with $567,762 in 1913, the decline being much smaller than in the bluestone trade. The largest item in the value was paving blocks which amounted to $279,687, against $239,389 in 1913. These were quarried almost entirely in Orleans county which also produced a large amount of curbstone; the entire quarry output of this county had a value of $439,635 against $467,636 in the preceding year.

An unusual number of quarries reported as inactive during the past year, especially in the bluestone district. In part this was due to the poor market for stone, the demand being very quiet throughout the year and the prices on a low basis. Another contributing factor was the putting into effect of the new workmen's compensation law which appeared so formidable to some mine and quarry operators that they preferred to go out of business than submit to its requirements.

Production of sandstone in 1913

DISTRICT	BUILDING STONE	CURBING AND FLAGGING	PAVING BLOCKS	CRUSHED STONE	RUBBLE, RIPRAP	ALL OTHER
Bluestone						
Hudson river	$5 977	$238 724	....	$2 250	$3 400	$11 094
Delaware river	51 611	251 080	....	250	3 029	....
Chenango county	66 645	7 523	....	....	....	817
Wyoming county	97 776	1 200	....	180	1 138	....
Other districts	5 636	5 080	....	....	100	....
Total bluestone	$227 645	$503 607	....	$2 680	$7 667	$11 911
Sandstone						
Orleans county	$21 636	$170 725	$230 397	$2 124	$23 791	$19 963
Other districts	36 364	8 652	8 992	41 463	4 655	....
Total sandstone	$58 000	$179 377	$239 389	$43 587	$28 446	$19 963
Combined total	$285 645	$682 984	$239 389	$46 267	$36 113	$31 874

Production of sandstone in 1914

DISTRICT	BUILDING STONE	CURBING AND FLAGGING	PAVING BLOCKS	CRUSHED STONE	RUBBLE, RIPRAP	ALL OTHER
Bluestone						
Hudson river	$5 500	$153 436	....	....	....	$1 559
Delaware river	20 196	177 200	....	....	$1 425	9 865
Chenango county	69 255	5 812	....	....	960	2 337
Wyoming county	92 201	1 000	....	$48	1 393	....
Other districts	4 087	40	....	....	....	....
Total bluestone	$191 239	$337 488	....	$48	$3 778	$13 761
Sandstone						
Orleans county	$15 926	$147 970	$266 775	....	$1 319	$7 645
Other districts	10 343	4 764	12 912	$36 095	6 927	....
Total sandstone	$26 269	$152 734	$279 687	$36 095	$8 246	$7 645
Combined total	$217 508	$490 222	$279 687	$36 143	$12 024	$21 406

TRAP

Trap is not a distinct rock type, but the name properly belongs to the fine-grained, dark-colored igneous rocks that occur in intrusive sheets and dikes. In mineral composition it differs from most of the igneous rocks that are classed in the trade as granite by the prevalence of the basic plagioclase feldspars and the higher percentages of the iron magnesia minerals, while it contains no quartz. Some of the so-called "black granites," however, are trap. The name is sometimes applied to fine-grained rocks of granitic or syenitic composition and sometimes even to rocks of sedimentary derivation, but such usage is misleading and indefensible.

The particular value of trap is due to its hardness and toughness. Its fine, compact, homogeneous texture gives it great wearing powers and it is eminently adapted for road metal and concrete of which heavy service is required. The principal product, therefore, is crushed stone. It has been used to some extent, also, as paving blocks, but these are rather difficult to prepare, since trap very seldom shows any capacity for parting comparable to the rift and grain structures of granites. As a building stone it finds very little application, probably on account of its somber color. The expense of cutting and dressing trap is also an obstacle to its employment for building or ornamental purposes.

The trap quarried in New York State is properly a diabase. Its mineral composition varies somewhat in the different occurrences,

but the main ingredients are plagioclase, feldspar and pyroxene, with more or less of amphibole, olivine, magnetite and sometimes biotite. The texture is characteristic, for the feldspar forms lath-shaped crystals which interlace and inclose the pyroxene and other ingredients in the meshes, and it is this firmly knit fabric which gives the stone the qualities of strength and toughness.

The largest occurrence of trap in New York is represented by the Palisades of the Hudson and the continuation of the same intrusion which extends southward through New Jersey onto Staten Island and is also encountered in the interior of Rockland county. The Palisades are the exposed edge of a sill or sheet of diabase that is intruded between shales and sandstones of Triassic age. The sheet is several hundred feet thick, in places nearly 1000 feet, and in general seems to follow the bedding planes of the sedimentary strata which dip to the west and northwest at an angle of from 5° to 15°. The outcrop is narrow, seldom over a mile, and in places is limited to a single steep escarpment. The principal quarries are near Nyack and Haverstraw at the base of the cliffs. Other quarries have been opened near Suffern, Rockland county, on an isolated intrusion, and also near Port Richmond, Staten Island, at the southern end of the Palisades sill.

Trap occurs in numerous places in the Adirondacks, but mostly as narrow dikes. It is especially common in Essex and Clinton counties where there are many thousands of dikes that range from a few inches to 20 or 30 feet thick. On the southern border of the region are a few dikes of notable size, such as that in the town of Greenfield, Saratoga county, and at Little Falls in the Mohawk valley. A quarry has been opened in the Greenfield occurrence for the supply of crushed stone.

The quarrying of trap along the face of the Palisades in Rockland county probably will soon be discontinued, as it is designed to purchase the quarry properties for the Palisades Interstate Park. The lands to be included within the park extend from the river line to the top of the Palisades. So far only the quarry of the Manhattan Trap Rock Co. has been taken over and closed, but negotiations are proceeding for the acquirement of the other quarries along the river front.

The future of the industry in this section is somewhat unsettled. It is not unlikely that new quarries may be opened on top of the ridge and in the interior of Rockland county, though the facilities for production and shipment in that section can scarcely be equal to those of the present localities.

Production of trap

MATERIAL	1913		1914	
	Cubic yards	Value	Cubic yards	Value
Crushed stone for roads....	631 134	$499 776	519 600	$420 280
Crushed stone for other purposes..................	640 165	501 394	455 400	350 320
Total................	1 271 299	$1 001 170	975 000	$770 600

The production of trap in 1914 was entirely by the quarries in the Palisades section of Rockland county, although in former years some has been produced in the Adirondack region. The statistics furnished by the companies show that the output was about 25 per cent, below the production of the preceding year, amounting to 975,000 cubic yards valued at $770,600 against 1,271,299 cubic yards valued at $1,001,170 in 1913.

TALC

The market for talc was depressed last year in sympathy with the general conditions and the slackening of demand in the paper trade which consumes the larger part of the local product. There is little reason for believing that the depression is anything but temporary, since the uses of talc have become firmly established, not only in paper manufacture but in many other industries, so that they are not likely to be displaced. On the other hand the market is likely to make considerable gains by reason of the curtailment in the supply of white clays which are employed in the coating of paper. These clays are largely imported, the shipments hitherto coming mainly from Germany, as they are not produced to any extent in this country. The ground talc from the Gouverneur district possesses a natural fiber which makes it specially valuable for use in paper; the material can be thoroughly incorporated with the vegetable fiber and adds strength to the latter. The talc is retained by the paper stock to a larger extent than is clay.

The Gouverneur talc district consists of a narrow belt, lying to the southeast and east of that village in the towns of Fowler and Edwards, in which the talc occurs in lenticular bodies arranged in series along the strike. The bodies dip uniformly toward the north-

west at angles of from 30° to 60°, so that they are all worked by underground methods. The wall rocks are limestone and schist of Precambric age, a part of the Adirondack crystalline formations. The fibrous talc is an alteration product of tremolite which it resembles in physical development, but the scaly talc apparently is the result of deposition by underground waters. Altogether there are fully fifteen or twenty different deposits, some of which, however, are not profitable under present conditions, and others are being held in reserve. The number of operative mines in recent years has ranged from five to eight or nine. The mines are opened by inclined shafts sunk on the footwall with levels driven from either side at intervals of 100 feet or less. The mining is simple and inexpensive, the main cost of the prepared talc being incidental to the mill treatment which involves reduction by several stages the final grinding being done in ball and tube mills. The final grinding requires from two to five hours.

The producers of talc in this district include the Ontario Talc Co. with a mine and mill near Fullerville, the Uniform Fibrous Talc Co. at Talcville, and the International Pulp Co. with mines near Talcville and Sylvia lake and mills at Hailesboro near Gouverneur. The Standard Talc Co. has a mine near Talcville, which was once worked by the United States Talc Co., but the company made no output last year. The North Country Corporation has been engaged lately in the development of a new deposit near Sylvia lake, town of Fowler.

The Gouverneur district first became an important shipper of ground talc about 1880, when the output amounted to 4000 tons, but it was developed a few years before that date. The production since has been continuous and in the last 20 years has averaged about 60,000 tons. The total product since the beginning has amounted to over 1,600,000 tons, worth about $14,000,000 at the average prices received at Gouverneur.

A deposit of talc near Natural Bridge has been worked for the last four years, and has supplied a considerable quantity of material which is sold in ground form. This deposit occurs in limestones, but in a separate area from the Gouverneur belt and has a quite different character. The talc lacks any definite structure, except that it shows a granular appearance in places, and is associated with other hydrated silicates of the serpentine and chlorite groups. It appears to be a contact deposit, lying near an intrusion of granite. An analysis of the material was given in the last previous issue of this report. The mine is operated by the St Lawrence Talc Co.,

Inc., the product being ground in a local mill which is equipped on the usual plan of the Gouverneur mills.

The production of both districts last year amounted to 74,075 short tons with a value of $671,286. This represented a large increase, as the total for 1913 was 63,000 tons worth $551,250. The prices were approximately the same as those received in the preceding year.

Production of talc in New York

YEAR	SHORT TONS	VALUE	YEAR	SHORT TONS	VALUE
1883	6 000	$75 000	1899	54 655	$438 150
1884	10 000	110 000	1900	63 500	499 500
1885	10 000	110 000	1901	62 200	483 600
1886	12 000	125 000	1902	71 100	615 350
1887	15 000	160 000	1903	60 230	421 600
1888	20 000	210 000	1904	65 000	455 000
1889	23 476	244 170	1905	67 000	519 250
1890	41 354	389 196	1906	64 200	541 600
1891	53 054	493 068	1907	59 000	501 500
1892	41 925	472 485	1908	70 739	697 390
1893	36 500	337 625	1909	50 000	450 000
1894	50 500	454 500	1910	65 000	552 500
1895	40 000	320 000	1911	65 000	552 500
1896	46 089	399 443	1912	61 619	511 437
1897	57 009	396 936	1913	63 000	551 250
1898	54 356	411 430	1914	74 075	671 286

ZINC

The zinc mine at Edwards, St Lawrence county, did not make any commercial shipments last year, but it produced a considerable quantity of ore in connection with the underground development that was continued from the previous season. This product is held for treatment by the new milling plant which was expected to be ready in the early part of 1915. The old mill was destroyed by fire after it had been remodeled and made ready for operations, and consequently shipments have been delayed beyond the period anticipated at the outset.

The general nature and occurrence of the zinc ores in this part of St Lawrence county have been described in previous issues of this report; no remarkable discoveries or new features have since come to light, and the main interest in the field at present centers upon the outcome of the single active enterprise which began the

development of the Edwards property several years ago. The results of the underground exploration, which has been carried on through two shafts, appear encouraging, as several thousands of tons of concentrating material carrying up to 40 per cent or more zinc have been uncovered. The product has been held in stock until it could be milled, as practically none of it is of shipping grade owing to admixture with pyrite. The first attempts in the separation of the minerals in which a special type of magnetic machine was employed did not prove a success. The ore was treated without previous roasting, as it was aimed to secure both the blende and the pyrite, the latter being in sufficient amount to make a valuable by-product if recoverable. The general run of the ore is fine-grained, and there is more or less serpentine and talc in the gangue, which may add to the difficulty of mill treatment.

The outcome of the present undertaking is naturally awaited with much interest; if successful it will mean a new industry in that section and will lead no doubt to other developments in the district.

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Appendix 2

Entomology

Museum Bulletin 180

180 30th Report of the State Entomologist 1914

University of the State of New York Bulletin

Entered as second-class matter August 2, 1913, at the Post Office at Albany, N. Y., under the act of August 24, 1912

Published fortnightly

No. 606 ALBANY, N. Y. JANUARY 1, 1916

New York State Museum

JOHN M. CLARKE, Director

EPHRAIM PORTER FELT, State Entomologist

Museum Bulletin 180

30th REPORT OF THE STATE ENTOMOLOGIST

ON

INJURIOUS AND OTHER INSECTS

OF THE

STATE OF NEW YORK

1914

The University of the State of New York
Department of Science, April 8, 1915

Dr John H. Finley
President of the University

Sir: I have the honor to transmit herewith the manuscript and illustrations of the Report of the State Entomologist for the year 1914 and to recommend that this be published as a bulletin of the State Museum.

Very respectfully
John M. Clarke
Director

THE UNIVERSITY OF THE STATE OF NEW YORK
OFFICE OF THE PRESIDENT

Approved for publication this 19th day of April 1915

John H. Finley

President of the University

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Museum Bulletin 180

30th REPORT OF THE STATE ENTOMOLOGIST 1914

Dr John M. Clarke, Director of the State Museum

I have the honor to present herewith my report on the injurious and other insects of the State of New York for the year ending September 30, 1914.

The extended injuries by the apple tent caterpillar and the forest tent caterpillar, noted last year, were continued during the past season. The work of the latter species was particularly evident on Long Island and in the Adirondacks. Popular warning notices were sent early to the press, and at Westbury and Elizabethtown power spraying outfits were used most successfully against the forest tent caterpillar. The ten-lined inch worm was locally abundant in the Catskills and in Washington county.

Oil injuries. The serious results following the application of petroleum compounds to the bark of dormant trees, noted in earlier reports, have again come under observation the past season. One of the most interesting of these was at Dalton, Mass., and resulted from the application in May 1913 of burlap strips soaked in lubricating oil to sugar maple trees set some ten or eleven years previously. The Entomologist has also examined a number of fruit trees in widely separated orchards where conditions favored the belief that the serious condition of the trees was due to an earlier application of a miscible oil.

Fruit tree pests. The studies of the parasitic enemies of the San José scale, begun in 1913, have been continued during the past year and have resulted in the finding of a number of orchards where these beneficial forms were abundant and apparently very effective

agents in checking this pest. The most efficient species is the recently discovered and newly characterized Prospaltella perniciosi Tower, a form which is widely distributed in certain sections of the State, at least. In spite of the abundance of these natural enemies we believe that, as a rule, fruit growers must continue to rely upon the application of lime-sulphur washes for the control of this scale insect.

Field studies of red bug injury have shown that in the Hudson valley, at least, the lined red bug, Lygidea mendax Reut., is the species responsible for most of the damage to the fruit. Orchard experience indicates that a nicotine preparation, such as black leaf 40, is one of the most effective sprays. It is probable that in the case of badly infested trees, a special application of nicotine and soap must be made somewhat later than it would be safe to use the lime-sulphur wash at winter strength.

The pear thrips continues to be a serious pest of the grower in the Hudson valley, appearing here and there in a most erratic manner and injuring Seckle and Bartlett trees, in particular. Observations show that orchards practically free from the pest one season may be seriously affected the next. A detailed account of this insect is given in the report for 1912. In at least one instance pear midge injury, supplementing the damage caused by the thrips, resulted in an almost total loss of the crop.

The pear psylla has continued its rôle as a serious enemy of the grower, being particularly abundant and injurious in certain extensive orchards in the vicinity of Milton and Marlborough. The practical value of late spring applications of a lime-sulphur wash for the control of this insect was demonstrated earlier, and observations in the above-mentioned orchards showed the necessity of carefully eliminating artificial shelters such as stone walls, brush heaps and even check trees if the best results are to be secured.

The banded grape bug, Paracalocoris scrupeus Say, noticed in detail in the report for 1913, has continued its injurious work. Through the cooperation of Mr L. F. Strickland of the State Department of Agriculture, a series of nymphs were received and detailed descriptions of the early stages are included in this report.

Gipsy moth. One of the worst infestations of the gipsy moth yet discovered in this State, was located last spring, through the cooperation of Mr F. A. Bartlett, at Mount Kisco. The infestation was of several years' standing and a few egg masses were found at a considerable distance from the center of the colony. Prompt and

vigorous action by agents of the Department of Agriculture has resulted in nearly exterminating this menace, and it is most earnestly hoped that in another year or two this outlying colony will be utterly destroyed.

Brown-tail moth. A scattering infestation of the brown-tail moth was discovered early in the year on Fisher's island and the eastern end of Long Island. The pest very probably drifted with the winds from the adjacent infested mainland of Connecticut. Systematic scouting and the destruction of over-winter nests by agents of the State Department of Agriculture and the Federal Government have prevented extended multiplication the past season. The abundance of oak on Long Island renders it very probable that this pest will breed freely unless checked artificially. The prevalence of this insect in large numbers would mean an inevitable drop in the high land values prevailing in that section. The Entomologist, cooperating with other local and State agencies, is endeavoring to arouse a general interest in the control of this insect while the infestation is in an incipient stage.

Grass and grain pests. There was an extended and serious outbreak of grasshoppers on the border of the Adirondacks, portions of Fulton, Saratoga and Warren counties, in particular, suffering greatly. Warning notices giving directions for checking the pests were issued before the situation was serious, and later at the request of the Governor, the Entomologist made a special study of the problem, and in cooperation with agents of the State Department of Agriculture, conducted a most satisfactory demonstration of the efficiency of poisoned baits. The grasshoppers of the State have been carefully studied in this connection and a detailed account of these insects, their capacity for harm and control measures are given on following pages.

There were numerous local and, in some instances, severe injuries by army worms in mid July and early August. These outbreaks invariably arouse considerable apprehension because of the masses of caterpillars, though as a rule the damage is restricted to comparatively small areas. The work of the past season demonstrated the utility of poisoned baits similar to those employed against grasshoppers. Newspaper bulletins giving full information respecting this insect and methods of control were issued at the inception of the attack.

Studies of white grubs and June beetles begun in 1912 were continued, one of the most interesting developments being the rearing of a number of a rather scarce robber fly, Promachus

fitchii O. S., from the large, white maggots observed in association with and preying upon white grubs during both 1912 and 1913. Observations were also made upon the numbers and injuries by the beetles, and late in the season upon the abundance of small white grubs, which latter when numerous invariably cause serious injury the following season. Local conditions were characterized in brief, practical accounts sent to papers circulating in sections where these pests were most abundant.

Grass webworms were prevalent and injurious to a number of cornfields in Dutchess county. Control measures, as has been demonstrated by earlier work, must be restricted largely to planting immune crops on badly infested land. These small insects are by preference grass feeders and, under normal conditions, may become exceedingly numerous on land allowed to lie in grass for a number of years. An interesting and rare type of injury was also observed in one of the infested fields. It was caused by a small, yellow field ant, probably Solenopsis debilis Mayr., eating out the contents of the kernel, and the corn sprout, thus deprived of its normal nourishment, developed very slowly. Brief accounts of these insects are given in this report.

Shade tree insects. Injuries by the elm leaf beetle continue as in previous years, though local restrictions are perhaps fully as marked as in earlier seasons. There was a great decrease in this pest in 1912, due, as we then believed, to abnormally low temperatures in mid June, and the same phenomenon, though to a somewhat less extent, was observed last season. The beetles appeared in large numbers, deposited eggs freely, and yet the subsequent damage was much less than would be expected from the early indications. Checks of this kind are temporary, more or less local and unreliable, as a rule.

The spruce bud scale, Physokermes piceae Schr., is a comparatively unknown pest in New York State. It has been found during the last two or three years in widely separated localities and appears to be responsible for some of the dying branches so frequently seen upon healthy trees. A somewhat detailed discussion of this insect is given on a following page.

The Norway maple, hitherto regarded as comparatively free from insect pests, has been shown by the developments of the past season to be subject to attack by a leaf hopper, Alebra albostriella Fall., and a scale insect, Leucaspis japonica Ckll., the former apparently very serious at times and the latter somewhat resembling

the common scurfy scale of the apple. Both of these pests are noticed elsewhere in this report in some detail.

Forest pests. The hickory bark beetle still continues as an important pest in the vicinity of New York City, and here and there in the Hudson valley, though the resultant damage does not appear to be so extensive and severe as in earlier years. It is to be expected that natural enemies will soon begin to regain the ascendency, which already seems to be the case to a limited extent. It is undoubtedly true that conditions have also been materially benefited by the somewhat general cutting and burning of badly infested trees.

The establishment of the recently introduced bayonet or posthorn pine borer, Evetria buoliana Schiff., in several New York localities adds another potentially important enemy to our list of pine pests. This European species has evidently been established in the country for several years, probably being brought here with nursery stock. The infestation is so limited that there is a possibility of exterminating the borer. A detailed account of this insect is given on subsequent pages.

The maple and oak pruner, a rather common enemy of oaks, in particular, has been unusually abundant and injurious, especially in the lower Hudson valley and, as a consequence, many inquiries have been received concerning this insect and methods of control. A brief practical account of this borer is given elsewhere.

The large European hornet, Vespa crabro Linn., became established in this country several years ago, and during the last year or two has attracted notice by its habit of removing the bark from small, living twigs or branches, birch suffering, in particular. Ordinarily this damage does not amount to much though it might be considered serious in the case of specimen trees or shrubs on lawns. A brief account of this insect is given in this report.

Garden or greenhouse pests. The large, brilliantly colored Say's blister beetle, Pomphopoea sayi Lec., has again attracted notice because of its unusual abundance in various localities in the State. The depredations of the past season were noteworthy, in that this insect was reported as having threatened with destruction the yield from an acre of beans.

Another unusual outbreak was that of the Juniper plant bug, Chlorochroa uhleri Stal., a stout, greenish, pink-margined stink bug which became excessively abundant and injurious at Quaker Street, Schenectady county. These bugs, ordinarily rare, were so numerous as to destroy many of the young peas while still in the pod and seriously affect the yield of several garden crops. Living speci-

mens were forwarded to the office and the Entomologist was able to confirm by actual observation, reports of injury to both corn and tomatoes.

The orchid Isosoma, I. orchidearum Westw., is rarely brought to the attention of the economic entomologist, partly because of its scarcity and probably also on account of the fact that orchid growing is a highly specialized and therefore fairly well-understood business. Pseudo-bulbs of orchids infested with this insect were received from Mount Kisco last July and later in the season orchid roots infested with the Cattleya midge, Parallelodiplosis cattleyae Moll., were transmitted by another person. Both of these insects affect the vitality of the plants and are briefly noticed elsewhere in this report.

Flies and mosquitos. The interest in the control of the house fly has continued, and early in the season the Entomologist prepared a brief folder concerning the house fly. This was widely circulated in a monthly bulletin of the State Department of Health and also issued as a separate.

Practical control of mosquitos has received its due share of attention, the Entomologist personally investigating a peculiar problem on the shores of Sodus bay. The investigations started the past season will be continued another year in an attempt to abate the mosquito plague associated with swamps lying practically at lake level.

Gall midges. The European box leaf miner, Monarthropalpus buxi Lab., has become well established on Long Island and is seriously injuring box hedges, since many badly infested leaves drop and the plants soon become very scraggy. A series of experiments have shown the practicability of destroying these miners while still within the plant, by the use of fumigants, carbon bisulphid being the most promising of these materials. A detailed account of this insect is given on subsequent pages.

Studies in this group (Itonididae) have been continued and a number of new species, mostly reared, and several new genera described. There have been a number of important additions in this group to the New York fauna. The American zoophagous species, mostly beneficial because of their preying upon other forms, especially scale insects, plant lice and plant mites, have been tabulated. This compilation shows a possible importance as natural checks hitherto scarcely suspected.

Lectures. The Entomologist has delivered a number of lectures upon insects, mostly economic forms, before various agricultural

and horticultural gatherings, some of them being in cooperation with the bureau of farmers institutes or county farm bureau agents. Several lectures have also been given under the auspices of local improvement associations.

Publications. A number of brief popular accounts regarding such common pests as the house fly, apple and forest tent caterpillars, the elm leaf beetles and June beetles, have been widely circulated through the press. The more important publications of the year are the Gall Midge Fauna of New England and several papers describing new genera and species of gall midges.

Faunal studies. The investigations of earlier years along these lines have been continued and there is now in manuscript a list of the insects of the Adirondack region, based mostly upon material in the State collections. There was some special collecting in the Adirondacks in connection with the investigation of grasshoppers noted above, and Assistant State Entomologist Young continued his studies of the fauna at Wells, paying attention to the hitherto largely neglected Mycetophilidae and obtaining a number of new species, and also of known forms not previously recorded from the State.

Collections. A large series of insects was obtained by purchase from the Kny-Scheerer Company of New York. These are for the exhibit collection now being prepared and were selected primarily because of their value in supplementing or elucidating the material already at hand. The similarities obtaining among insects in different sections of the world, the remarkable developments in certain highly specialized forms, and the enormous size of some species are well illustrated in these recent acquisitions.

Through exchange with Mr C. W. Johnson of the Boston Museum of Natural History, the State Museum has acquired a series of 83 species (listed elsewhere) of two-winged flies, mostly unrepresented in the collections. These being determined by a well-known authority in the group, constitute a notable addition to the State collections.

We have been fortunate in receiving, through exchange, from Prof. S. I. Kuwana of the board of plant inspection, Imperial Ministry of Agriculture and Commerce, Tokio, Japan, specimens of 30 species of Coccidae, a number of them representing species described by Professor Kuwana and therefore particularly desirable.

Accessions, such as the above, add greatly to the value of the State collections, especially when the group is economically important, as is the case with the Coccidae or scale insects. There have been numerous additions during recent years in this family. Miss F. T.

Hartman was assigned the duty of assembling and listing the species now represented in the State collections. The list reproduced on subsequent pages shows that we now have 181 species, 72 of which have been mounted on microscopic slides, 4 being represented only by such preparations. There are 41 species from Japan, 28 from California, 7 from the Philippine islands and 9 types and 7 cotypes. This assemblage is a most valuable aid in determ ning scale insects so frequently submitted for name. The Coccidae are so readily transported with nursery stock, that species of extralimital forms are very desirable. Only last summer there was found on Norway maple, a Japanese species which may prove of considerable economic importance.

Additions are constantly being made to the State collections, especially of specimens representing the early stages and work of various injurious forms, since biological material of this character greatly facilitates identification of the different insects and is ndispensable in a well-prepared exhibit illustrating the life histories of different species. The State collection now contains a large amount of material which is invaluable because of the associated data. Many miscroscopic preparations of smaller insects have been made and incorporated in the collections as in earlier years.

The arrangement and classification of the collections requires a large amount of time. The many additions must be interpolated and there are numerous groups still far from being thoroughly classified. The large series of Lachnosterna captured during the past summer were determined by Mr Young. The collection of grasshoppers taken in connection with the grasshopper investigations referred to above, necessitated the rearrangement of the Orthoptera by Mr Young.

The need of additional boxes or trays referred to in the previous report still exists. The wooden cases containing the insect collections should be replaced by steel cabinets and more provided to accommodate the extra boxes and trays required. No adequate provision has as yet been made for the constantly increasing biological material, which is also true of the large number of microscopic slides, many of them containing types of species and genera and therefore impossible of duplication. A metallic filing case for the collection of negatives and photographs is also greatly needed.

Nursery inspection. The nursery inspection work of the State Department of Agriculture results in numerous specimens representing any stage in insect development, some in a very poor condition, being submitted to the Entomologist for identification. As such

material may originate in a foreign country, determinations of this character are laborious and require for their successful prosecution a large collection and an excellent library of both domestic and foreign works. The correct identification of such material is very important, since the disposal of entire shipments of nursery stock must depend in considerable measure upon the character of the infestation.

General. The work of the office has been materially aided as in past years, by the identification of a number of species through the courtesy of Dr L. O. Howard, chief of the bureau of entomology, United States Department of Agriculture, and his associates. A number of correspondents have donated valuable specimens and many have rendered efficient service by transmitting local data respecting various insects. It is a pleasure to note that there has been, as in the past, a most helpful cooperation on the part of all interested in the work of the office.

Respectfully submitted

EPHRAIM PORTER FELT

October 15, 1914 *State Entomologist*

INJURIOUS INSECTS

LINED RED BUG

Lygidea mendax Reut.

The observations of the past season show this species to be common and rather generally distributed in the Hudson valley and the one usually responsible for the increased red bug injury to apple orchards. A number of field studies were made for the purpose of securing data which might be of value in controlling the pest.

Examinations of northern spy and greening trees in the orchard of Mr W. H. Hart, at Arlington, on May 14th showed a rather general infestation. The young bugs were evidently just hatching, as some of them were of a pale yellowish red color, while a few were beginning to show the characteristic deep red. The more tender unfolding leaves were indistinctly reddish-brown spotted here and there, and presented somewhat the appearance of having suffered from sun scald. Such injury was almost invariably closely associated with the presence of one or more small red bugs. Eleven days later, evidences of injury were more marked and the young bugs were mostly in the second stage, a few apparently just entering the third. On June 25th adults of this species were common y present throughout the orchard, two or three being easily found on many of the trees. A number were captured and in no case were we successful in securing specimens of the other red bug, Heterocordylus malinus Reut. They all belonged to the above named species. It was found that the adults cou d be rather easily caught by holding a hat just below the insect and then jarring the foliage from above. It was necessary to move rather quietly and quickly and just after the jarring be ready to knock the bug back into the hat or it would escape. Some quickness and care are necessary to capture the specimens without crushing them badly. By July 16th there were comparatively few red bugs to be found in this orchard, though the insects had been numerous a short time before and occurred at that time rather abundantly in one orchard only about a mile away.

Examinations of various orchards in the Hudson valley resulted in our finding numerous evidences of the work of this insect, and in a number of cases adults were taken, they in each instance proving to be the lined red bug. In addition to infesting a number of orchards near Poughkeepsie, the species was found to be rather nu-

merous at Bangall and also at Milton, Ulster county. Similar conditions, though without excessive injury, were observed in localities in both Columbia and Rensselaer counties. Specimens were received from a Washingtonville, Orange county, orchard and also from Mount Vernon, Westchester county. The general distribution of this insect in this apple-growing region is favorable for serious and sporadic injury, such as has obtained at Poughkeepsie for the last two or three years. If the grower would avoid a heavy loss it is necessary to watch this pest and prevent its becoming excessively abundant.

Signs of red bug injury. The earlier signs of damage by this species are found in the indistinct reddish brown spotting of the more tender opening or recently unfolded leaves. This discoloration has been compared to the appearance presented after a light dusting with red pepper. As the injured leaves age the discoloration becomes somewhat darker and after a time the central portion of the more seriously affected tissues may die and drop, leaving an irregular series of reddish, brown-margined holes in the somewhat curled, crumpled leaves. Affected foliage, unless very badly injured, usually remains upon the tree throughout the summer and affords one of the readiest means of detecting the work of this pest. The damage to the foliage, while of some consequence, amounts to little compared with the injury to the young fruit.

The earliest evidence of injury to the small apple is a slight exudation accompanied by a local discoloration and hardening. The young fruit is frequently pierced to the core and as growth continues, depressions with pithy centers extending deep into the tissues may be noted. There is also a marked irregularity in the shape of the apples. This damage may be distinguished from somewhat similar appearing aphis injury by the fact that the blossom end is not puckered or deformed, a modification frequently following plant louse attack. Many apples are dwarfed and drop about midsummer.

The red bugs them elves rarely attract notice, though the young, which are bright in color, shelter themselves largely in curled leaves and may generally be found near the tips exhibiting the characteristic injury. The adults are about a quarter of an inch long, reddish in color, and likewise are most often found near affected foliage. This lined red bug may be separated from the sometimes associated true red bug, by the black line along the posterior margin of the pronotum, while the other is distinguished by the rather numerous fine, whitish scales on the head, thorax and wings. Both young and adults are active and are very likely to dodge to the other side of a leaf or twig when approached.

Remedial measures. Experiments and practical experience have shown that many of these insects can be destroyed with a tobacco preparation, 40 per cent nicotine used at the rate of three-fourths of a pint to 100 gallons of water. This may be applied as a separate spray to which 5 or 6 pounds of soap are added to increase the spreading properties, or it may be put into either the usual lime-sulphur, San José scale or codling moth sprays. If the latter is done, it is advisable to delay the winter application for San José scale as late as possible, in order to catch the young bugs hatching just before the blossoms break from the bud, and then to spray for the codling moth just as soon as practical after the blossoms fall. Last year Mr W. H. Hart added the tobacco to the usual lime-sulphur and arsenate of lead spray, making the application as soon as practical after the dropping of the blossoms. This work was done under our supervision, May 25th, at a time when the young bugs were mostly in the second stage, a few just entering the third. Examinations showed that some of the insects were destroyed by this treatment, though not all, because living red bugs were found in the orchard later. Mr Hart was of the opinion that great numbers of the pests were killed by the nicotine, which is undoubtedly true. Special spraying for this insect is particularly advisable when there is a light crop, since the grower, under such conditions, can not afford to have many apples deformed. In cases of bad infestation, especially in extensive orchards, it will probably be necessary to make a special spraying with nicotine and soap somewhat later than it would be safe to use the lime-sulphur wash at winter strength, and then to supplement this by as early spraying for codling moth with nicotine added as practical.

WHITE GRUBS AND MAY OR JUNE BEETLES

The white grub outbreak in 1912 was so severe and general in Albany, Columbia and Rensselaer counties as to arouse much interest in the pest and in practical methods of preventing serious damage. The trouble of that year, as has been explained repeatedly, had its inception in a large flight of May or June beetles in 1911 and the depositing of their eggs in many of the best mowings. White grubs were consequently so abundant the next season (1912) as to gnaw off most of the grass roots so that mowing machines and horse rakes frequently tore up large areas of what should have been vigorous and productive grass land.

The outbreak of 1912. Aside from the damage caused, it was considered advisable to watch developments for the purpose of securing additional data which might prove of value in practical control

work. At the outset it should be stated that these grubs, at the time the injury was most apparent, were about a year old. They had hatched from eggs laid the preceding June and were destined to live a second winter as grubs and change to beetles in August or September 1913. The adults, though fully developed in late summer or early fall of that year, did not appear above ground till May and June 1914.

A number of sample diggings were made in the spring of 1913, for the purpose of ascertaining the conditions of the insects and the relative mortality. Numerous full-grown grubs were found, as many as nine being uncovered in an area of approximately one and one-half square feet. A few adults of Lachnosterna fusca Froh. occurred with the white grubs and there is a possibility that some individuals of this species may complete the life cycle in two years, though the developments of the past season (1914) conclusively establish a three-year cycle as the normal.

The most interesting development was the discovery of numerous large Dipterous maggots in 1912. These preyed upon the white grubs and were carried through the season of 1913, and adults were secured in the spring of 1914, showing the species to have, like its host, a three-year life cycle. This efficient enemy of the white grubs proved, upon rearing, to be a common robber fly known as Promachus fitchii O. S.

Observations in 1914. The abundance of beetles in 1911 and the occurrence of many white grubs in the soil in 1912 and early the following season, made it comparatively safe to predict a large flight for this year. About May 14th, the beetles began to be abundant in and about Nassau, and on the 16th to the 18th they were common on the streets and reports of unusual numbers began to be received. Similar conditions were noted at Clinton Heights and on the Capitol grounds at Albany. Collections May 19th at Nassau resulted in taking in the early evening Lachnosterna fraterna Harr. almost exclusively from bushes on low ground near a stream, while later in the evening almost equal numbers of this species and L. fusca Froh. were collected under electric lights somewhat remote from the above-mentioned low ground. There were marked differences in the abundance of the insects about various lights, even in cases where there were approximately equal areas of grassland near by, though in a general way the pests were more abundant around the outlying village lights.

The feeding of the beetles, while injurious to trees, may be taken advantage of to some extent to indicate the approximate amount of injury which may be expected from the grubs the following season.

A considerable variety of trees are subject to attack by May and June beetles, the following list giving the trees in about the order of their preference by the beetles, so far as southern Rensselaer county is concerned: oak, ash, hickory, butternut or black walnut (both are probably equally susceptible), elm and birch. The sugar maple appears to be almost exempt from injury. Trees standing by themselves in pastures or grasslands or on the edges of mowings showed the most severe injury, and the damage was frequently confined largely to the sides next the sodland. The feeding in the case of large trees standing by themselves was most marked on the outer portions and especially the tops of the trees, indicating that the beetles as they emerged from the grass flew moderately high and confined themselves largely to the more tender outer foliage. A number of oaks, in particular, were so badly injured that practically all the leaves were destroyed on the upper two-thirds of the branches, while the remainder were almost uninjured. The concentration of attack upon the tops of the trees is also noteworthy in woodlands. This injury was so severe in a number of places that farmers were of the opinion that the tops of some trees, at least, had died as a result of the attack. This injury, so far as the agriculturist is concerned, is much less important than the damage caused by the white grubs. The amount of feeding on forest trees, as pointed out above, is significant as an index for approximating the probable abundance of white grubs the following season.

Captures of Lachnosterna and associated species

	ALBANY		NASSAU			BOSTON CORNERS	BRONXVILLE	ORIENT	HOLLIS	Totals
	May 31	June 2	May 19	June 2	June 9	June 10	June 7, 10	June 25	May 30	
Lachnosterna [1]										
fusca Froh......	34♂	17♂	29♂	17♂	7♂	......	11♂	......	22♂	137♂
	24♀	27♀	...	27♀	5♀	......	36♀	6♀	8♀	133♀
fraterna Harr....	31♂	4♂	36♂	4♂	...	2♂	1♂	......	......	78♂
	13♀	6♀	15♀	6♀	...	......	......	......	......	40♀
hirticula Knoch..	3♂	...	...	...	...	......	93♂	16♂	10♂	122♂
	1♀	...	...	...	...	......	40♀	16♀	7♀	64♀
crenulata Froh...	...	...	...	...	...	......	2♂	......	......	2♂
arcuata Sm......	...	...	...	...	...	......	1♀	......	......	1♀
micans Knoch...	...	...	...	...	...	......	12♂	......	......	12♂
	...	...	...	...	...	......	1♀	......	......	1♀
tristis Fabr......	...	...	...	...	...	......	......	25♂	......	25♂
	...	...	...	...	...	......	......	90♀	......	90♀
dubia Sm.......	1♂	...	...	...	...	5♂	......	19♂	......	25♂
	...	...	...	...	...	2♀	......	12♀	......	14♀
barda Horn.....	...	...	...	...	...	......	1♂	......	......	1♂
Ligyrus										
relictus Say.....	...	...	...	...	...	......	3	......	1	4
Diplotaxis										
liberta Germ.....	...	...	2	...	...	......	2	......	......	4
Serica										
serica Ill........	...	...	...	...	...	......	......	1	......	1

Determinations by D. B. Young, confirmed by J. J. Davis.

A scrutiny of this tabulation shows that in Albany and Rensselaer counties, L. fusca Froh. and L. fraterna Harr. were about equally abundant and far outnumbered other species so far as average grasslands are concerned, the first-named being much more numerous than the other. In Westchester county L. hirticula Knoch. appears to be the most abundant, L. fusca Froh. and L. micans Knoch. ranking in the order named. The swarms of May beetles at Hollis were mostly L. fusca Froh., though there was a goodly number of L. hirticula Knoch. in the collection sent, which was probably representative. A late June collection at Orient gave practically no L. fusca Froh., a number of L. hirticula Knoch., many L. tristis Fabr., and a number of L. dubia Sm., the last ranking second in the point of numbers from a presumably representative collection. The totals clearly show a large predominance of L. fusca Froh. with L. hirticula Knoch. coming next and closely followed by L. fraterna Harr. and L. tristis Fabr. This data agrees fairly closely with the estimate of these species for New Jersey, published by the late Doctor Smith in 1909. The other species mentioned in this tabulation are of minor importance.

An examination October 5th of grassland near oaks which were so badly injured last June that their owner, Mr F. B. Smith of Schodack, feared that he might lose his trees, disclosed an interesting condition. On digging at the base of one oak, a number of dead beetles as well as several grubs were found, while representative square feet of apparently good sodland 100 and 150 feet from trees were found to contain 10 and 13 grubs each. Portions of the field showed an excellent growth of grass, indicating a satisfactory start after mowing, while in other parts there was almost nothing green. An examination of the latter areas showed that most of the grass roots had already been destroyed. The young grubs, then only one-fourth to one-half of an inch long, were found mostly in and about the roots of the grass an inch to two inches below the surface, while an occasional specimen had worked its way down to a depth of approximately three inches. It is possible in this way to gain a very definite idea of white grub conditions, and if this be done early enough, it would frequently be possible to handle this land in such a way as to secure a good crop in spite of the pests.

Habits of beetles. They begin to appear above ground from the early part to the middle of May and remain abroad till the latter part of June, feeding upon the leaves of various trees and shrubs at night and retiring to the shelter of grass and grain fields for the day.

The flight from the fields to the trees begins just about dusk — from a little before eight till a little after eight during the latter part of June and extends over a period of only fifteen to twenty minutes as recorded by Mr J. A. West. The beetles remain in the trees during the night and at the break of day, about the time the first bird notes are heard, namely between three and four o'clock in the morning, the return to the grass fields begins and is rapidly accomplished. Experiments conducted several years ago by Professor Forbes clearly show that the beetles fly considerable distances in the search of food trees, since comparatively few beetles were captured in trap lanterns distant from trees and so protected that the lights would not attract the insects from the trees. There is little or no moving and feeding when the night temperature is below 52° F. and the minimum for normal activities is 60° F. Pairing occurs during the feeding period at night and the eggs are deposited in balls of earth about one-half of an inch in diameter and lying from one to five or six inches below the surface.

Habits of the grubs. The small, white grubs two to three months old are found until in early fall at least, as shown by our observations, among the grass roots and within two or three inches of the surface. With the approach of cold weather the grubs descend to a depth of six inches or more, remaining quiescent in oval cells during the winter and in the spring slowly make their way to the surface and feed upon the superficial grass roots. The grubs are sluggish creatures and move slowly, so that anything like a migration is impossible, though conditions in infested fields plainly indicate more or less of a movement from badly injured sod to the comparatively uninjured outlying grass. Occasionally the reverse is true and there may be somewhat of a concentration of the grubs in a central, comparatively unharmed patch. In July of the third summer they construct oval cells in the soil and change to pupae, the latter transforming to beetles in August or September and the perfect insects appearing the following May or June, thus completing the three-year life cycle.

Natural enemies. White grubs are greedily devoured by pigs which, where possible, should be given the run of badly infested fields. The common skunk, although in ill repute because of its love for chickens, searches out and destroys a great many of the grubs, frequently clearing the pests from considerable areas.

Studies in Illinois by Dr F. E. L. Beal in 1894 showed that crows ate either beetles or grubs in every month of the year from March to October, inclusive. The large size of this bird and its ground-feeding

habits makes it particularly efficient in destroying white grubs, though it also possesses some undesirable traits. Blackbirds are also known to feed upon white grubs. English sparrows were observed last summer destroying many of the beetles in and around the electric lights of Albany.

Several parasites prey upon these insects. One of the most common is known as Tiphia inornata Say. The oval, brown cocoons of this species are about three-fourths of an inch long and may be distinguished from those of an allied form by the slight neck or constriction at one extremity. These cocoons are frequently rather abundant in fields which have been badly infested by white grubs. Another large parasite, Myzine sexcincta Fabr., preys upon white grubs and spins a cocoon similar to that of Tiphia though differing in its greater smoothness and lacking the loose, fluffy coating of silk. Ophion bifoveolatum Brulle. has been reared from white grubs, and as there are a number of closely related species, some of which are quite common, it is probable that this insect and its allies are frequently very efficient checks upon the white grubs.

A large, milk-white maggot with a hard integument and black mandibles was extremely abundant at Schodack in 1912 and 1913 in fields badly infested with white grubs, and upon rearing, it proved to be a rather common robber fly known as Promachus fitchii O. S. The maggots live in the soil for a period of over two years and the insect evidently has a three-year cycle, which would indicate an adaptation to the habits of their prey, the white grubs. These beneficial larvae were abundant in a number of areas where white grubs had evidently destroyed most of the grass roots, though at the time of our examination very few remained alive. On the other hand, places were found near by where there were numerous white grubs and comparatively few of these beneficial maggots. This, taken in connection with the maggots actually being seen attacking the white grubs, leaves no doubt as to the beneficial habits of this comparatively unknown species. This robber fly was unusually abundant last summer at Nassau. A bee fly, Sparnopolius fulvus Wied., has been reared in Illinois from white grubs and has somewhat similar habits to those described above for Promachus. The peculiar and striking Pyrgota undata Wied. has also been reared from white grubs, but unfortunately both of these last-named species appear to be comparatively rare in New York State.

White grubs are also subject to fungous attack. The white grub fungous, Cordyceps ravenelii Berkl., occurs here and there

throughout the State. Infected grubs are easily recognized by the slender, hornlike processes arising from beneath the head and frequently attaining a length three or four times that of the host. These growths are at first green and later turn brown.

Preventives and remedies. The three-year life cycle and the marked tendency of the beetles to deposit their eggs in the more luxuriant grass, makes it comparatively easy to anticipate injuries, particularly if some attention is paid to the amount of feeding by the beetles upon forest and other trees.

The eggs are laid in June, and in September or early October the small, white grubs are readily found about grass roots and usually within three inches of the surface of the soil. These pests are then from one-fourth to one-half of an inch long and, if abundant at this time, the probabilities are that the sod, and with it, the crop will be destroyed early the next season. Land badly infested in this manner should be plowed as soon as possible, disked once or twice and, if practical, fowls or hogs allowed to run over the ground for a time to destroy many of the pests. It is unsafe to plant such land to potatoes, corn or other susceptible crops. Small grains, especially rye, buckwheat, clover and vetch are much more likely to escape serious injury, and if the plowing and seeding is early enough, it may be possible to avert entirely the injury which would normally occur the next season if nothing was done. It is fairly safe to assume that land in good cultivation the year the beetles fly, will not be badly infested with grubs the next season, even though in localities where serious outbreaks occur. It may be better to replant such land to corn or potatoes rather than to adhere to the usual and generally advisable rotation and put crops liable to injury on badly infested sodland.

The extended life cycle of these insects and their restriction to grasslands make it apparent that a systematic rotation of crops is one of the most important preventive measures that can be employed. A rotation which does not allow land to remain in sod for more than two or three years, if generally followed in a neighborhood, will result in reducing the danger of serious injury from these pests to a minimum. Such farm practice is also advisable from the general agricultural standpoint.

The danger of losing the crop when corn, potatoes or strawberries are planted upon recently turned infested sod, should be more generally recognized. The severe damage following such practice is due largely to the great reduction in the number of plants for each acre and the inevitable concentration of the grubs upon the small

amount of food available. There is nothing to show that the white grubs migrate to any great extent, more than a rod or two, through the soil. Susceptible crops, if they must be put on infested soil, should be fed liberally and cultivated thoroughly in order to assist the plants to withstand the injury. Strawberry plants set on infested land are liable to be destroyed unless the grubs are systematically dug out and killed. This, unless the infestation is very severe, is practical though somewhat costly.

FOREST TENT CATERPILLAR

Malacosoma disstria Hübn.

The season of 1914 was marked by an extension of the forest tent caterpillar ravages of recent years. Specimens or complaints were received from a number of Nassau county localities, from Delaware and Chenango counties and from areas in Saratoga, Washington, Warren, Essex, Clinton and St Lawrence counties, in particular.

These pests confine themselves on Long Island mostly to oaks, while farther north sugar maples, and in the Adirondacks poplars were largely defoliated, extensive areas in St Lawrence, Essex and Warren counties suffering severely. This is the third successive season during which these pests have been destructive in the State. The probabilities favor less injury another year, since serious outbreaks of this character are generally limited by the activity of various natural agents within three or four years. It is possible to forecast fairly accurately the relative abundance of this pest by examining the smaller twigs of favored food trees for the rather short, square-cut, light-brown egg belts. The occurrence of any number of eggs is an almost unfailing indication of serious injury next season.

Early history. This insect is a well-known forest and shade tree pest on account of its irregularly periodic outbreaks. Extensive injuries were recorded for western New York in 1857, and ten years later it was reported as having been troublesome in that section for a period of twelve years or more. A minor outbreak occurred in Washington county in 1889, and from 1897 to 1900 there were extensive defoliations in widely separated localities — the damage probably being considerably greater than in the present 1912–14 outbreak.

The pest has been active in other sections, both of the last-mentioned caterpillar outbreaks manifesting themselves in adjacent territory east and north of New York. The Central and Southern States have suffered severely in earlier years, extensive areas of oaks in Missouri, Tennesee and other states being defoliated.

Description. The caterpillar can be easily distinguished from the common apple tent caterpillar by the row of somewhat diamond-shaped, whitish spots down the middle of the back and by its feeding mostly upon oak, sugar maple and poplar, trees rarely attacked by the apple tent caterpillar.

The egg belts are also characteristic in being smaller than those of the apple tent caterpillar and with the ends terminating rather abruptly. The light brown protective covering usually has one or two transverse wrinkles or depressions.

The white or yellowish white cocoons are frequently spun in leaves on the trees or on the ground and also occur in crevices of the bark, under stones, in fence corners and in almost any convenient shelter.

The moths are light buff colored insects with a wing spread of one and one-eighth to one and one-fourth inches and with markings of darker brown. The male may be recognized by its richer coloring, smaller size and feathery antennae.

Life history and habits. The well-developed caterpillars winter within the egg and with the appearance of warm weather begin to emerge and commence feeding upon the unfolding leaves. There may be variations of a month or so in the hatching; this species is decidedly later than the more familiar apple pest. When not feeding the young caterpillars assemble in clusters on the limbs and as they increase in size, molt from time to time, leaving their cast skins in small clusters on the bark. The latter frequently give rise to the report that many of the pests have succumbed to frost or other adverse climatic conditions. Early injuries are confined mostly to the tops of the trees, and as the pests increase in size the tendency is to crawl farther down the trunks and to form larger clusters during the resting periods. A serious infestation means the stripping of the trees while the caterpillars are still partly grown and a forced migration for food. The full-grown larvae obey a natural impulse and crawl in all directions seeking for suitable shelters in which the final transformations may take place. The pupal stage lasts about two weeks, the moths appearing the latter part of June and during July, mostly in the latter month. The eggs are soon laid and remain upon the twigs unhatched until the following spring.

Food plants. Various oaks in the Southern States and on Long Island, the sugar maple and the American poplar, Populus tremuloides, are favorite food plants. In the Adirondacks the pin or bird cherry, elms and Cornus close to poplars were badly eaten or nearly stripped, while red maple and birch were almost exempt from injury unless close to defoliated trees. All the coniferae were

practically unharmed. Apple orchards are occasionally injured by the caterpillars, the larvae apparently thriving upon this tree.

In addition to these, this species has been recorded as feeding upon linden, locust, peach, plum, cherry, rose, sweet gum, dogwood, black gum, sour gum, black walnut and hickory.

Natural enemies. Some thirty-two species of native birds are known to feed upon forest tent caterpillars, the robins, orioles, vireos and nuthatchers being particularly serviceable. The encouragement and protection of native birds would seem to be one of the most economical methods of preventing periodical outbreaks by this and other destructive leaf feeders, particularly those confining their attacks largely to forest trees.

A number of predaceous and parasitic insects prey upon the caterpillars. It is probable that prior to the studies of Mr A. F. Burgess on certain Carabidae, the value of predaceous beetles as natural enemies had been greatly underestimated. His work has shown that the introduced European Calosoma sycophanta is a remarkably efficient enemy of the gipsy moth and there is no reason why it and its allies should not be of material service in controlling outbreaks by native species. Several Hymenopterous parasites have been reared in numbers from the cocoons of the forest tent caterpillar, though certain Dipterous parasites appear to be even more efficient natural checks.

Rearings last summer from lots of cocoons received from various localities showed a relative scarcity of natural enemies, considering the fact that this outbreak was of several years standing. For example, from one lot received from Westbury, 8 moths and only 6 parasites were obtained, another from Port Henry produced 39 moths and but 7 parasites, while a third lot from New Russia yielded 3 moths and no parasites. These figures would indicate that material reduction in the pests another season can hardly be attributed to the beneficial activity of parasites.

Remedial measures. Forest tent caterpillars are easily controlled by early and thorough applications of a poison, such as arsenate of lead, using 2 pounds to 50 gallons of water. The best results are secured if the application is made before any material injury is caused. The need of this treatment, as pointed out above, can be accurately forecasted by examining the trees any time during the winter for the purpose of determining the abundance of the egg belts. Recent advances in the development of spraying outfits have resulted in an equipment which makes it possible to spray fairly open forest lands for the very moderate sum of $5 or $6 an acre. These

figures obviously apply to fairly large tracts where favorable conditions obtain.

Small trees or a few trees can be protected from injury by the removal, during the winter, of the egg masses, though this method has obvious restrictions. Under certain conditions it may be advisable to offer prizes to school children for the collection of egg masses, though in the case of the forest tent caterpillar it would generally be found that the eggs are too high in the trees to permit much being accomplished in this manner. Hundreds of cocoons of this pest are spun in accessible places, and although the time during which effective work can be done is limited to approximately two weeks, it is possible to collect and destroy many of the insects in this stage with comparatively little effort. The best results will be secured if, instead of burning the cocoons, they are placed in tight receptacles covered with a wire netting having a one-fourth inch mesh. This would prevent the escape of the moths and allow the numerous parasites, usually occurring in the cocoons, to gain their freedom.

Trees adjacent to badly infested areas can be protected from the invasion of caterpillars by the application of sticky bands to the tree trunks. One of the best banding materials is tree tanglefoot. Coal tar can be used for this purpose though it should not be applied directly to the trunk but be underlaid with a thickness of stout building or roofing paper. Bands saturated with oils or greases should never be applied directly to the trunks of trees, since there is a probability of serious consequences resulting. A band of cotton about 8 or 10 inches wide, tied tightly in the middle around the tree and the upper portion turned down over the string and allowed to hang loosely, is a fairly efficient obstacle to climbing caterpillars. These bands are also of service in preventing caterpillars which fall to the ground in high winds or which may be jarred from trees, from reascending.

Bibliography. A detailed account of this insect with a limited bibliography is given in New York State Museum Memoir 8, volume 1, pages 106–15.

Oil injury. The outbreak of forest tent caterpillars for the last year or two has resulted in the adoption of various devices for the purpose of lessening the damage. In May 1913 one person applied burlap strips soaked in lubricating oil to a number of sugar maple trees set some ten or eleven years before at Dalton, Mass. These bands were for the purpose of preventing caterpillars from ascending the trees. The maples apparently leaved out normally the following spring and the first observed injury was noted in August 1914

and was indicated by the leaves falling quite generally. An examination showed that a five-inch band of bark under the burlap had died and become loose. In some instances it was stated that 80 per cent, presumably referring to the circumference, were girdled. An attempt is to be made to offset this dangerous condition by bridge grafting.

The main point we wish to emphasize is that the application to the bark of dormant trees, especially sugar maples, of an oily substance is dangerous and very liable to be followed by disastrous results. If it is necessary to apply such bands, the trunk of the tree should be protected by an underlying layer of tarred paper or some other impervious material and the band removed as soon as it has served its purpose which, in the case of forest tent caterpillar outbreaks, would mean within four or five weeks. A safer and fully as satisfactory a material for banding purposes is the tree tanglefoot which has been so extensively employed in portions of New England nfested by the gipsy moth.

BROWN-TAIL MOTH

Euproctis chrysorrhoea Linn.

Last winter a number of the hibernating webs of the brown-tail moth were found upon Fisher's island, a few upon Gardiner's island and a number on the eastern end of Long Island, especially in the vicinity of Easthampton. The distribution of this infestation strongly suggests that the moths were carried by northeast breezes from the adjacent mainland, since this insect is known to occur on the Connecticut shore near Fisher's island. The distribution is so peculiar that one can hardly attribute it to any transportation agency or the shipment of infested nursery stock.

Significance of this infestation. The invasion of Long Island by this moth means its establishment in a section where there is an abundance of oak, one of the preferred food plants upon which this noxious and pestiferous insect thrives. If this pest is allowed to multiply unchecked it will shortly spread over the entire island and many extremely desirable localities may be rendered almost uninhabitable by the abundance of the caterpillars and the severe and distressing annoyance caused by the irritating hairs of the larvae. The experience in New England is that summer resorts badly infested by this insect are avoided and in some cases almost deserted. It is unnecessary to add that such a condition would mean serious losses to many localities, not to mention the depreciation in value of many estates in which large sums of money have been invested.

Present conditions. Agents of the Department of Agriculture and the Federal Bureau of Entomology, following the discovery of the pest in New York, carefully scouted the territory last winter, removing and burning all the nests that could be found. This work was done so thoroughly that an examination October 23, 1914, of a portion of the infested area near Easthampton resulted in finding no hibernating webs containing living caterpillars. The work of last winter showed that the infestation on Long Island was confined largely to wild cherry trees, though in Massachusetts this insect displays a marked preference for the oaks. The most obvious explanation we can suggest is that the wild cherry trees, standing as they do mostly beside clear fields, have a theoretically better chance of attracting the moths, as they presumably drift indiscriminately over the land, than would be the case with the oaks which in that section occur in large clumps or cover extended areas. There may be in reality just as serious an infestation in the latter, though the presence of the pest is largely concealed by the small numbers in relation to the amount of available food.

Future treatment. It is obvious that this insect should not be allowed to multiply in this State, and for the present at least there is no better method of preventing a rapid infestation than by a systematic scouting of the infested territory and of any sections liable to be infested by this insect. Experience in the gipsy moth work in Massachusetts has shown that woodland such as that occurring on eastern Long Island can be scouted for about 25 cents an acre, provided there is no serious infestation. This is a very moderate expenditure, when we consider the benefits which should accrue from the work. The excellent results following the scouting of last winter is an indication of what may be expected if the work is continued along the original lines. The location of Long Island is such that unless there is a very large flight and spread of the moths from the mainland, the chances are very good of eliminating and preventing the infestation of the extensive oak areas. We believe that the high land values, the large investments and the comparative isolation of the island amply justify unusual efforts to protect an exceedingly beautiful and highly desirable territory.

Owing to the large areas liable to infestation, it is desirable to secure the cooperation of all interested persons in watching for the appearance of the pest, and on this account brief descriptions of the various stages are given below, together with a summary of the habits of the insect.

Description. The hibernating or winter nests are of prime importance in locating an infestation, since they are readily discovered

through the winter after the leaves have fallen. These webs are four to six inches long, occur on the tips of the smaller twigs and invariably have one or more leaves spun into the structure. In the interior of the nest there are pockets lined with soft, white silk containing a number of small, reddish brown caterpillars about one-fourth of an inch long.

The moths have a wing spread of about one and one-fourth inches and are nearly pure white, except for the conspicuous reddish brown tuft at the tip of the abdomen. The adults are found only the latter part of June or in July and may be easily recognized by these characteristics. The eggs are laid in July upon the leaves in masses of two hundred to three hundred and covered with brown hairs from the tip of the abdomen. The eggs hatch in August and the young caterpillars commence to feed and construct their shelters. The webs may be easily distinguished from those of the common apple tent caterpillar or the fall webworm, since the tent caterpillar makes its webs in the forks of the branches, whereas those of the brown-tail moth occur at the tips. The fall webworm makes much larger and more open webs than the brown-tail moth and rarely attacks pear, which is a prime favorite of this introduced species.

The caterpillars become full grown in June and then have a length of one and one-fourth inches. The head is pale brown, mottled with dark brown and the body dark brown or black with numerous fine, dull orange or gray spots over the surface. The body is sparsely covered with reddish brown, finely barbed hairs arising from warts or tubercles, and on each side there is a series of oblique, elongated, whitish markings. These, in connection with the small, bright red tubercles on the top of the tenth and eleventh segments afford the most ready means of identifying the caterpillars.

The writer has published a detailed description of the hibernating larva in New York State Museum Bulletin 103, page 16.

Life history. The partly grown caterpillars winter in the hibernating webs described above. They begin feeding with the appearance of the leaves in the spring, working downward from the tip of the branches and leaving the twigs naked with a grayish web at the top. All but the midrib is devoured except in the case of trees like the Sycamore maple, when the larger ribs also are untouched. When full grown the caterpillars disperse to some extent, which is more marked in localities where the food supply is exhausted early. Several caterpillars frequently pupate in a common cocoon, within the leaves, at the tip of the branches and sometimes in masses under fences or on the trunks and larger branches of trees. The moths fly the latter

part of June or early in July, sometimes being carried long distances by the wind. The eggs are laid usually on the under side of the leaves and the young caterpillars commence feeding in early August and cease eating preparatory to hibernation the latter part of September or in October.

ARMY WORM

Heliophila unipuncta Haw.

The army worm outbreak of last season approached in severity the extended devastations of 1896, though the area of severe damage was much more limited. The pests appeared to be most abundant upon Long Island, especially the eastern end, and also in a group of counties in the western part of the State, notably Cattaraugus, Chautauqua, Erie, Genesee, Livingston, Niagara and possibly Cayuga.

Earlier outbreaks. In view of the localized injury noted above, it is interesting to refer to the earlier history of this pest. It is stated that in 1817 many meadows and pastures in the northern towns of Rensselaer county and in the eastern portions of Saratoga county were rendered " as barren as heath." Some injury from this species was reported in the western part of the State in 1842, and in 1861 there was a serious outbreak in the vicinity of Buffalo, near the head of Seneca lake and at several other points in the southern and western counties. It was reported in 1871 from Tioga county, and four years later was quite abundant on Long Island the latter part of July and the middle of August. It again became destructive on Long Island in 1880, the caterpillars being numerous in June. This outbreak also occurred in some of the southern and eastern counties of the State.

The pest was so generally prevalent throughout the State in 1896, that the obvious concentration of severe damage to Long Island and a portion of the western part of the State was not so evident as in the case of the earlier outbreaks.

Actual losses in 1914. The presence of the army worm was reported to this office from about twenty counties, and at the time the insect appeared there was a noticeable tendency on the part of both individuals and the public press unduly to magnify the amount of injury, and on this account the Entomologist went to some pains to secure conservative estimates of the actual damage, some of which are reproduced below.

Allegany county. Mr F. C. Smith, manager of the county farm bureau, states that the army worm was very prevalent and estimates the damage in the county at $1000. The insects were not sufficiently abundant so that there was any extended marching.

Broome county. Mr E. R. Minns, manager of the county farm bureau, states that the damage was not very serious, being confined mostly to city lawns or gardens and a few farms. A few fields of oats were cut for hay in order to save them from injury.

Cattaraugus county. Mr H. E. Crofoot, manager of the county farm bureau, records some injury to corn and serious damage to oats, the loss being about one-third on 500 to 600 acres, the average yield from uninfested fields being 27 bushels an acre.

Cayuga county. Mr C. R. Teall, manager of the county farm bureau, reports an infestation comprising about 150 acres, many of which were practically ruined, while in others the injury was small, it averaging for the infested area approximately 50 per cent.

Chautauqua county. Mr Hawley B. Rogers, manager of the county farm bureau, states that the pest was generally prevalent and estimates the damage to the oat crop at approximately 10 per cent, though in some fields it ran as high as 25 per cent.

Chemung county. Mr M. E. Cleubbuch, manager of the county farm bureau, states that the army worm did not do much damage.

Cortland county. Mr E. H. Forristall, manager of the county farm bureau, reports two local outbreaks, one resulting in the destruction of a large piece of oats and the other not causing any amount of damage.

Dutchess county. Mr F. H. Lacy, manager of the county farm bureau, reports a number of complaints of injury to oat fields, the loss ranging under 25 per cent and being confined to a relatively small proportion of the planted area. The aggregate loss in the county would run into thousands of dollars.

Erie county. Mr F. L. Strickland, horticultural inspector of the State Department of Agriculture, reports a general infestation with occasional severe injury in the northern half of the county, some twenty acres of pasture near Lancaster being destroyed in addition to injury to corn, in a few cases the entire crop being ruined.

Mr W. L. Markham, agent of the farm bureau, placed the loss at thousands of dollars and states that the injury occurred here and there over the county and in some cases acres of oats were practically destroyed.

Genesee county. Mr L. F. Strickland, horticultural inspector of the State Department of Agriculture, reported a general infestation in the northern half of Genesee county and records five acres of corn and at least forty acres of pasture as being destroyed by the pests.

Jefferson county. Mr F. E. Robertson, manager of the county farm bureau, reports three small outbreaks with a total loss of not over $150 and a freedom from injury in the clay soil districts.

Livingston county. Prof. G. A. Bailey of the Geneseo Normal School, reports a general distribution of the pest near Mount Morris, the damage, however, appearing to be confined to a relatively small area. He estimates the severely injured area at nearly 900 acres.

Monroe county. Mr Lewis A. Toan, manager of the county farm bureau, reports injury from only five towns, there being a few fields with perhaps one or two acres of sod that were considerably damaged. He values the crop on this land at about $5 an acre, consequently the total loss was not heavy.

Niagara county. Mr L. F. Strickland, horticultural inspector of the State Department of Agriculture, reports an infestation, especially in the southeastern corner where 60 acres of oats, 11 acres of corn, 5 acres of barley and about 10 acres of pasture were destroyed. In addition, some 20 acres of hay were injured before cutting. He estimates the severely injured area in the southern part of Niagara county at 300 acres.

A similar report was received from Mr E. H. Anderson, manager of the county farm bureau.

Ontario county. Mr D. D. Luther reported a somewhat severe though very restricted outbreak at Naples, and so far as we have been able to learn, there were no extended injuries in that county.

Oswego county. Mr E. Victor Underwood, manager of the county farm bureau, reports a limitation of the injury to two sections, namely, in the region of Mexico and in the northern part of the county in the vicinity of Sandy Creek. In the latter region the oats were cut for hay and the resultant loss was therefore not serious.

Queens county. Dr David T. Marshall of Hollis states that the pests occurred in isolated fields and lawns and, in his judgment, the damage was not great.

Suffolk county. Mr Roy Latham of Orient states that practically all timothy fields were infested, and as a result the grass was cut two to three weeks before maturity. The army worms then migrated and caused much damage to corn. There were very few parasitic flies observed on the first brood of caterpillars and, as a consequence, the second brood, appearing in July and August, were very destructive. These latter were abundantly parasitized and the third generation in late September and October appeared in Hungarian grass and caused very little damage.

Tioga and Tompkins counties. Mr V. B. Blatchley, now manager of the Tompkins County Farm Bureau, reported the pests as very

abundant on restricted areas in both counties and estimated the loss at less than $1000.

Wyoming county. Mr H. M. Bowen, manager of the county farm bureau, reported that the army worm was not prevalent throughout the county and records injury to only one or two fields.

In addition to these, negative reports were received from Clinton, Delaware, Oneida, Onondaga, Otsego, St Lawrence and Ulster counties. The Entomologist, from personal knowledge, could add several others to the list of counties where there was very little or no injury by the army worm.

Description. The eggs are rarely seen; they are smooth, white when first laid, turning gradually to a pale straw color before hatching, and are usually deposited in masses glued together by an adhesive substance. The practical point in this connection is that the moths generally select the toughest stalks of the thickest clumps of vegetation when about to deposit eggs.

Young caterpillars. The young caterpillars, likewise rarely noticed, have a brownish black or yellowish head with dark eyes, the body being dull transluscent white with minute scattering hairs. These young caterpillars are only about .07 of an inch long and walk in a looping manner.

Full-grown caterpillars. The full-grown or nearly full-grown caterpillars, the stage usually attracting attention, present quite a range of color though the general appearance is fairly characteristic. The larger caterpillars are about one and one-half inches long. They may be recognized by the median white line beginning at the head and extending a variable distance along the back; in some of the lighter and younger ones it may be traced the length of the body. Either side of the median white line there is a brown, broad stripe more or less distinct, which may be mottled with white in the lighter individuals; this stripe is bordered laterally by a narrower one of dark brown. Next there is a white line similar to the median one but more constant, and between it and the next white line there is a stripe of variable brown sometimes mottled with white; this is usually lighter than the stripe on either side of the median white line; the stigmatal stripe comes next and this, in well-marked individuals, is the most striking, it being as dark as any, and below it there is the white substigmatal stripe; these last two are somewhat variable. The ventral surface is a variable yellowish green. The prolegs or abdominal legs are brown at the base.

Pupa. The mahogany brown pupa is about three-fourths of an inch long, rather stout, and at the posterior extremity there is a pair

of slightly converging spines and on each side of these, two fine, curled hooks; the spiracles are nearly black. The pupae are found just beneath the surface of the soil.

Moth. The moth is a plain appearing, reddish gray or fawn-colored insect with a wing spread of about one and one-half inches. The forewing is peculiar because of the small, characteristic, angular, white spot near the middle. These characteristics will serve for the recognition of the adult.

Life history and habits. There were two destructive broods in 1896, and the same conditions appear to prevail the present season, since moths were reported by Roy Latham at Orient as late as November 28th. This record was accompanied by the statement that a few pupae were being turned out by the plow. Doctor Howard considers there may be as many as six generations annually in the Southern States.

The accepted life history in this State may be briefly summarized as follows: Overwintered moths or recently emerged ones, which may hibernate as larvae or possibly pupae, deposit eggs early in the spring and from them the first brood of larvae develop. These latter, on account of their comparatively small numbers, rarely prove destructive and are consequently unnoticed. They complete their growth, pupate, and the moths emerge and lay the eggs from which is produced the second and usually destructive brood of caterpillars or army worms. These become nearly full grown early in July, and at about this time the reports of serious injuries are generally received. This second generation of caterpillars pupates the later half of July and the moths emerge early in August. They in turn, deposit eggs the latter part of the month and early in September the third brood makes its appearance, and by the latter part of the month is full grown. This generation occasionally becomes quite injurious, as was the case at Ghent, N. Y., in 1896, the larvae pupating the last of September or early in October and moths emerging the last of October and into November and probably wintering as adults.

The habits of the moths are of considerable importance in practical control work, since outbreaks are most likely to occur where adults are numerous and deposit eggs freely. The moths fly in the early evening hours or during the day in cloudy weather and are probably capable of long, sustained flights. There is a suspicion that injuries in the north by this insect may be due to extended flights of the adults, a theory which is supported in part at least, by the long flights of the allied cotton moth, Alabama argillacea Hübn. The army worm moths feed upon a variety of blossoms and also upon fruit,

such as red berries of the Tartarian honeysuckle. The eggs are ordinarily deposited in thick tufts of grass, the oldest and toughest stalks being selected and the eggs thrust down between the sheath and the stalk and usually secured by a gummy secretion. There is an evident preference on the part of the insect for cut straw in old stacks and hayricks, etc. in the early part of the season. The frequent occurrence of army worm outbreaks near rather low areas, especially in the vicinity of thick growths of coarse plants, is undoubtedly due to the moths searching out such conditions for the deposition of eggs.

Habits of the caterpillars. The young caterpillars hatch from the eggs in eight to ten days and remain in hiding most of the time, feeding only during cloudy weather and at night. At first they eat only the lower surface of the leaf and in about a week begin to gnaw holes in the sides of the leaves. As growth continues there is a marked increase in the feeding, and if the pests are at all numerous, nearby provender is soon exhausted and the caterpillars are then forced to move or march in the search of additional forage. This extension of the feeding area may be scarcely noticeable or moderate if the pests are not too abundant, or in the case of severe outbreaks, especially if these occur in connection with the local scarcity of food, may result in extended injuries, such as the destruction of acres of grain, corn or even grass. The detection of an outbreak in one locality is significant only as it indicates the probability of local conditions being favorable for the abundance of the insect. There is no danger of the caterpillars marching any great distance, five hundred to a thousand feet would probably represent the maximum, and this would be reached only under exceptional conditions.

Natural enemies. Army worms are subject to attack by a number of natural enemies, especially the maggots of a grayish fly somewhat resembling, though considerably larger than, the ordinary house fly. The most important is known as the red-tailed Tachina fly, Winthemia quadripustulata Fabr., a species which sometimes occurs in swarms in badly infested fields and the one frequently responsible for the almost total annihilation of a destructive generation. It is rare, if the second brood of army worms be abundant, to have serious injury by the third generation, although the normal prolificacy of the insect, if unchecked, would mean much more extended damage. This beneficial fly and its allies deposit oval, white eggs about one-twelfth of an inch long on the body of the caterpillar, usually just behind the head, and wherever egg-bearing army worms are numerous the chances of the succeeding brood causing little damage are excellent.

In addition to the parasitic flies mentioned above, there are a number of four-winged parasites which render material aid in checking this species. Predaceous beetles, especially the common ground beetles and their voracious larvae, are sometimes abundant and destroy many of the pests.

Native insectivorous birds are also valuable allies in controlling this pest. The chipping sparrow, English field sparrow, song sparrow, robin, flicker, bluebird, blackbird, kingbird, cowbird, catbird, pheasant, yellow-legs and upland plover, being recorded [1] as feeding upon army worms; the robin being considered one of the most efficient. Mr A. C. Weeks of Brooklyn cites in the local press [2] one case in which birds quickly cleared an infested field. Poultry and toads are also credited with devouring many of the caterpillars.

A deadly bacterial infection sometimes destroys large numbers of the pests. Unfortunately the effectiveness of this disease appears to be very dependent upon favorable climatic conditions and is therefore of limited value.

Adverse climatic conditions have an important influence and it has been held that a dry season followed by a wet one is likely to be an army worm year, though probabilities based upon any such data must of necessity ignore the extremely valuable services rendered by natural enemies. It is very likely that large numbers of the insects succumb to the rigors of our winter climate, otherwise the first brood of the caterpillars would probably be more injurious than later generations, owing to the smaller amount of forage available in the spring.

Control measures. Clean culture, which in this instance means the elimination of walls, brush and stone piles with their usual margin of coarse, rank vegetation, is an important step in discouraging oviposition by the moths and thus preventing an outbreak.

Little can be done to save a field generally infested with army worms, aside from cutting and harvesting the crop at once in order to prevent further injury.

It is important to meet an outbreak at its inception. In early July it is not a difficult task to find the caterpillars some days before they are usually seen. The thickest portion of a field should be examined for their small, black or brown droppings and injury to the lower leaves of the grass or grain. If these signs of injury are present, the army worms may be found hidden under loose shelter of any kind on the ground or just below the surface. Knowing the conditions it is then comparatively easy to decide whether or not to cut

[1] 1914 Fernald, H. T. Mass. State Board of Agric., Cir. 22, p. 11.
[2] 1914 Brooklyn Daily Eagle, Aug. 6, p. 3.

the crop at once. Such precautions are particularly advisable in sections liable to attack and in many localities where army worms are known to be prevalent.

Barriers. Crops adjacent to a badly infested field may be protected from invasion by the use of various barriers, such as a ditch or a deep furrow with its perpendicular side toward the field to be protected. If the army worms are abundant, holes about two feet in depth should be made in the bottom of the furrow at a distance of fifteen to twenty feet. The caterpillars falling into the ditch crawl along it and soon collect in these depressions where they can be readily crushed or destroyed by applications of oil or other deleterious materials. Ditches or furrows should be watched to keep the sides next the crop to be protected smooth and perpendicular and the depression from being bridged over by the accumulated bodies of the caterpillars.

Broad bands of tar, where conditions permit, may also be used as a barrier, or the tar may be applied to boards set up on edge. Tree tanglefoot could be used in the same way.

Barrier strips of poisoned vegetation are sometimes employed. A strip a rod or so in width is sprayed with a heavy dose of poison, preferably Paris green used at the rate of at least 1 pound to 50 gallons of water. The poisoned portion of the crop should be carefully destroyed in order to prevent its being eaten later by domestic animals.

Poisoned bait, especially for limited infestations in the vicinity of dwellings, has been used very successfully. The Kansas bait, the formula for which is given on page 47, may be used for this purpose. This bait may be spread rather thickly across the line of march or sown broadcast in a badly infested field. The distribution should be rather sparse; otherwise there will be great danger of poisoning birds.

Bibliography. A detailed account, with an extended bibliography, is given by Lintner in the twelfth report on the Injurious and Other Insects of the State of New York, 1896, pages 190 to 214.

EUROPEAN PINE-SHOOT MOTH

Evetria buoliana Schiff.

The establishment of this European insect in several New York localities means the addition to our fauna of another serious pine enemy. It is considered in Europe as one of the most destructive insects to young pines, owing to its attacking the buds of the terminal cluster, especially the leader, and the consequent deformation of the

tree. The most characteristic type of injury is the peculiar bend, owing to the borers feeding mostly upon one side of a shoot and resulting in a bayonet or posthorn deformity termed by the French and Germans, respectively, as " baionette " and " posthörner." The appearance of a badly infested shoot with four or five buds killed, is shown on plate 3, figure 3.

History of the American introduction. This insect, discovered early in the season, was undoubtedly imported with European pines and, judging from the condition of certain infested trees on Long Island, has been in this country three or four years. It is known to occur in New York State at Great Neck, Westbury, near Mineola and at Yonkers, while a recently issued circular of the Federal Bureau of Entomology records it in addition, from Massachusetts, Rhode Island, Connecticut, New Jersey and Pennsylvania. This wide dissemination was undoubtedly brought about by the shipment of infested trees, since the condition of the trees attacked indicates a probable local habit for the adults.

Food plants. This borer has been recorded as infesting all kinds of European pines and as equally injurious to American pines grown in Europe.

General characteristics of attack. The destruction of terminal buds produces a marked deformation which can not be confused with the work of the white pine weevil, Pissodes strobi Peck, or with that of our native pine twig borers, such as Evetria frustrana Scudd., or Pinipestis zimmermani Grote. The first attacks the bare twigs almost exclusively, while our native pine twig moth borers confine their attacks to individual shoots, frequently producing a dead tip here and there two to three inches long. This recently introduced European pest habitually attacks several adjacent buds, destroying or deforming them while in an incipient stage (Plate 3, figure 3). Here and there one may find a peculiar bayonet-shaped deformation, though on badly infested trees dead, partly developed buds are much more numerous. Trees in the latter condition may be well headed back, stunted and with almost every terminal showing several small, dead shoots. As many as six buds may be destroyed in one whorl. The early stages of infestation are indicated only by the rather obscure exudation of pitch, frequently rather granular, at the base of the buds, and on examination a brown, black-headed borer may be found within.

Life history and habits. There is but one generation annually in Europe, though fears have been expressed that the different climatic conditions of America may result in the production of two broods.

On the continent the moths fly in June and July and deposit their eggs singly the latter part of July or in August on the terminal bud whorls. The caterpillars hatch late in the summer and gnaw the side of the bud, causing a flow of pitch which covers the borer and forms a hibernating shelter, according to Gillanders, though our own examinations show overwintering larvae within the bud or an adjacent portion of a twig. With the appearance of warm weather. namely in April and May, the borers resume activities, attack adjacent buds and then kill or injure most of the shoots or buds of a cluster. The more advanced shoots are usually injured so that they lop or bend down, and as growth continues there is a turn upward and the characteristic bayonet or posthorn deformity results. Smaller or younger shoots may be tunneled and destroyed. The borers confine themselves to the more tender, soft growth and cease feeding the latter part of May or early in June, and pupate in the hollow shoots. The duration of this latter stage is variously given as from ten to about twenty-one days. The appearance of the moth is preceded by the pupa pushing itself partly out of the burrow. The moths issue in this state mostly during June.

Description. *Moth.* Wing spread 18 to 22 mm. Antennae brownish. Head and thorax pale yellow. Eyes black. Abdomen dark gray. Forewings yellowish red, the red heightened by very variable silvery cross-lines. The hind wings are a uniform dark gray with pale gray fringes.

Larva. Length 21 mm. Head, thoracic shield and true legs black, the body dark brown.

Pupa. Length 1.5 mm, yellowish brown, the dorsum of the abdominal segments with conspicuous, transverse rows of chitinous tubercles.

Distribution. This species has been recorded by Meyrick from western central Europe and northern Asia.

Control measures. The boring habits of the caterpillar preclude the use of ordinary insecticides and, judging from the apparently local habits of the moths, it should be comparatively easy to control this pest in nurseries and on small trees at least by cutting out and burning all infested shoots during the fall and winter. It should be possible, in many localities, practically to exterminate the species by thorough work as indicated above, and where this is attempted it is advisable to supplement the winter pruning by examining the trees again in May or early June for the purpose of removing any infested tips which may have escaped previous observation.

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BOX LEAF MIDGE

Monarthropalpus buxi Lab.

The European leaf miner of the box has evidently become well established in this country. It was first brought to our notice as an American insect by the reception in May 1910 of infested leaves from Prof. A. E. Stene, who collected them at Newport, R. I. Subsequent investigations have shown this insect to be thoroughly established on Long Island. The box on one large estate at Roslyn was generally infested and many of the plants were in a somewhat weakened and very unsightly condition as a result of its attacks. Reference to European literature shows this insect to be a common and in some localities, a destructive pest. Professor Chaine even attributing the death of box plants in the public garden of Bordeaux to the work of this insect.

Signs of infestation. The presence of this pest is indicated by more or less irregular, oval swellings on the leaves (Plate 2, figure 1), each marking an eccentric, oval, clear space mined beneath by one or more pale yellowish-white maggots about one-sixteenth of an inch long. There may be a very slight elevation on the leaf with an irregular, yellowish or brownish discoloration, the margin of the enlargement being indicated by darker green. This condition is most easily noted in September and later after the maggots are more than half grown. An infested leaf may contain only one or two of the miners and show comparatively little injury, or there may be six or more of the pests with an accompanying destruction of the larger part of the leaf. This attack, as intimated above, weakens the plant and results in the badly infested leaves dropping in the spring, leaving unsightly, bare stems with new leaves developing at the tip.

Description. The gall produced by this insect has been described above. The midge is a slender, fragile, yellowish fly about one-twelfth of an inch long and remarkable because of the long legs and antennae. Technical descriptions of both sexes and the larvae are given below.

Male. Length 2 mm. Antennae nearly as long as the body, sparsely haired, reddish; 14 segments, the fifth having the basal portion of the stem with a length twice its diameter, the distal part with a length three times its diameter. The enlargements bear whorls of rather stout, curved setae, the basal one and the distal two circumfili, the loops of the latter, being short, stout and approaching those of Hormomyia; terminal segment with the basal enlargement subglobose, the basal portion of the stem short, irregular, the distal enlargement with a length one-half greater than its diameter, somewhat rounded and bearing apically a broadly pyriform, subsessile appendage. The palpus consists of one large segment somewhat expanded distally and sparsely setose. Mesonotum, scutellum and postscutellum a variable yellowish orange, the submedian lines sparsely haired. Abdomen sparsely haired, a variable orange, the basal segments lighter, the distal bright orange. Genitalia fuscous yellowish. Wings hyaline, costa dark brown, the third vein uniting with the margin at the apex of the wing. Halteres orange basally, fuscous yellowish distally. Legs a nearly uniform yellowish orange, the claws tapering, simple, the pulvilli rudimentary. Genitalia; basal clasp segment stout; terminal clasp segment short, stout, the dorsal plate broadly and triangularly emarginate, the lobes broadly rounded, the ventral plate long, broadly and roundly emarginate, the lobes tapering.

Female. Length 2.5 mm. Antennae extending to the fourth abdominal segment, sparsely haired, reddish; 14 segments, the fifth with a stem one-half the length of the cylindric basal enlargement, which latter has a length three times its diameter and rather high circumfili at the basal third and apically; terminal segment with a length twice its diameter, irregularly obtuse. Body a nearly uniform reddish orange, and the abdomen sparsely haired. Ovipositor short, broadly rounded and with a curved, chitinous spine having a length about one-half that of the abdomen. Other characters about as in the male.

Exuviae. Length 2.5 mm, pale yellowish orange, cephalic horns short, broadly triangular, the thoracic horns slender, slightly curved. Wing covers extending to the third abdominal segment,the leg cases to the fourth. The surface of the abdominal segments finely granulated; posterior extremity with a pair of submedian, broadly triangular, chitinous processes.

Larva, hibernating. Length 1.75 mm. slender, yellowish green, the head broadly rounded anteriorly, the antennae biarticulate, stout, the distal segment with a length nearly three times its diameter; breastbone bidentate, the anterior portion dark brown, the shaft semitransparent, obsolescent. Segmentation distinct, the skin

coarsely shagreened; posterior extremity broadly rounded and with a pair of submedian processes, the latter irregularly subconical and indistinctly segmented.

Life history. Material obtained from Rhode Island in 1910 produced numerous midges the latter part of May, which is probably about the time that the flies might be expected to issue in Long Island localities. The observations of Professor Chaine, extending over a period of three years at Bordeaux, France, showed that the earliest pupae were observed from the 1st to the 25th of March, the earliest adults appearing from the 24th of March to the 16th of April. His investigations demonstrated that the period of oviposition lasts two to three weeks, the female normally selecting the younger leaves and depositing the eggs singly at a distance from each other and in a small slit cut by the bladelike ovipositor. Doctor Laboulbene, after studying this insect in Paris, states that the adults appear from early to the middle of May. Professor Chaine obtained no evidence of the midges feeding, though he observed that they were strong flyers, since they were found two hundred meters from the nearest box and at a height equal to the first story of a house.

The first indications of attack, according to Professor Chaine, are very small, rounded points on the under side of the leaves, indicated only by a slight change in color. There is a slight increase in the size of the discolored areas during the first week of June, and the second week a small, yellowish spot may be visible upon the upper surface of the leaf, and on the under side there is a relatively great development due to the young maggots enlarging their mines. These latter increase in size and a week or two later may extend to the edge of the leaf and become confluent. As a result, infested leaves in September and October show one or more large mines inhabited by two to three or more larvae. Frequently most of the tissues on one or both sides of the leaf may be attacked by these maggots, though as a rule the mines on opposite sides of the midrib do not coalesce. Winter is passed in these shelters, the larvae transforming to pupae and the latter partly issuing through a circular hole prior to the appearance of the parent fly the latter part of May or early in June. There appears to be but one generation annually.

Natural enemies. A number of gall midges, at least, are subject to attack by natural enemies, though as yet we have been unable to obtain any parasites from this species. There is a record of M. Decaux having reared one Chalcid, species undetermined. The mere fact that there are records of severe injuries in Europe by

this midge would suggest a probability, at least, that ordinarily it was not particularly destructive, and if this be the case, natural enemies, especially parasites, are probably the controlling agency. If such exist they should be obtained and colonized in this country so as to provide for a more or less perfect natural control.

Remedial measures. The investigations of Professor Chaine lead him to advise the dusting of the under side of the leaves with flowers of sulphur, making the application at about the time the midges commence to fly and, if necessary, repeating it once or twice in order to secure complete protection. He advises a preliminary wetting of the foliage and then the dusting from the under side. He is of the opinion that even road dust is nearly as effective, and was led to adopt this method after observing the comparative immunity of box plants growing near dusty highways. More or less difficulty would be experienced in keeping the leaves sufficiently dusted to produce the desired results, and in the case of an ornamental plant this is to be avoided if possible.

Two or three sprayings of a contact insecticide such as kerosene emulsion or a whale oil soap solution applied when the midges are beginning to issue and distributed during the period of flight, appeared to be very effective in controlling this midge, according to statements from Mr Butterton of Newport, R. I., received through the kindness of Prof. A. E. Stene of Kingston.

A series of laboratory experiments were conducted by the Entomologist last fall for the purpose of ascertaining the possibility of destroying these miners while still within the leaves. Carbon bisulphid, ammonia gas, hydrocyanic acid gas and vapors from flake napthalene were the materials employed. There was no difficulty in killing the larvae with the first two named, and the maggots showed the effects of treatment with the latter two. The great difficulty with ammonia was that it seriously injured the foliage as well as destroyed the maggots. These laboratory experiments indicate a probability, at least, that fumigation with ordinary commercial carbon bisulphid, using one teaspoonful for each five quarts of space and continuing the action at least one hour and probably two or three hours, would result in the death of most of the maggots with little or no material injury to the box plants. It would be necessary only to provide some suitable form of an air-tight, flexible box or tent which could be put over section after section of the infested hedge. The insecticide should be placed in shallow pans or saucers. The larger the area of the liquid, the quicker evaporation and more effective the treatment, other things being equal. We are

inclined to believe that fumigation with this material could be done to the best advantage in early July and thus destroy the young maggots before there was any material injury to the foliage. The experiments referred to above were conducted in October and consequently after much of the injury had been caused. There is a bare possibility that the physiological resistance of the small larvae is greater than that of those half grown, a matter which should be carefully tested another season.

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GRASSHOPPERS

New York State suffered last summer from an almost unprecedented grasshopper outbreak. The pests were confined largely to the sandy areas bordering the Adirondacks and extending from Poland, Herkimer county, through Fulton and Saratoga counties north to Warren and Clinton counties, though isolated outbreaks occurred on limited areas in other sections of the State.

Reports of the unusual abundance of grasshoppers and accompanying injuries came in early June. Press bulletins giving directions for the control of the pests were prepared and sent to newspapers in the infested region. This was supplemented by personal observations in and about Gloversville July 10th, and a week later, at the request of the Governor, the Entomologist went to the infested region and, in cooperation with agents of the State Department of Agriculture and others, proceeded to push an aggressive campaign against the pests. It was ascertained at the outset that while the grasshoppers moved freely from field to field and invaded the more attractive grain, yet in a wider sense the insects were local. The extended flights recorded of western species did not occur and a study of the situation convinced us that individual effort would, as a rule,

be nullified to only a very slight extent by migration. Throughout the region there was a general feeling that it would be comparatively useless for the individual to take up what seemed to be a very uneven conflict.

With these conditions in mind, a large scale demonstration was started July 18th. A badly infested oat field of about 22 acres was selected for the test. The Kansas bait, consisting of 20 pounds of bran, 1 pound of Paris green, 2 quarts of cheap syrup, 3 lemons and $3\frac{1}{2}$ gallons of water was used. The bran and Paris green were thoroughly mixed while dry, the juice of the lemons was squeezed into the water and the remaining pulp and peel cut fine by running it through an ordinary meat grinder. The poisoned bran was well dampened or mixed with this liquid, producing a moist though not sloppy preparation. This was distributed over the field, beginning about 10.30 o'clock in the morning, much as grain is sown, a good handful making three or four throws and covering approximately 200 square feet. It was the intention to use about 4 pounds of bran to the acre, but as a matter of fact it was approximately 6, owing to the difficulty of securing a uniform distribution. The poisoned bait was so thinly spread in the field that one had to look closely in order to find it. Observations showed that many grasshoppers began to feed upon the bait within three or five minutes after it fell to the ground and, in some instances, they seemed to drop from the oats, being attracted by the smell, and gradually made their way to small particles of the bait. About four hours after the first application, namely, 2.30 o'clock in the afternoon, a few sick grasshoppers were noticed here and there. At 6.30 o'clock the next afternoon, less than 36 hours after the beginning of the treatment, three-fourths of the grasshoppers in this field were dead or dying, twelve to fourteen dead insects being easily found on a square foot and frequently six or seven were collected in a small crevice as many inches long. There was a noticeable tendency to collect in hollows or at the base of the grain stalks. Practically the same conditions obtained the next morning. Three days after the application it was estimated that about four-fifths of the grasshoppers were dead, sixty-seven being found in one square foot, an average square yard contained twenty-six dead grasshoppers and another sixty-four. Five days after the bait was distributed, sick grasshoppers were still to be seen, though there had been a heavy two-hour rain the day before and the efficiency of the bait was probably decreased. The next day it was estimated that over nine-tenths of the grasshoppers originally in the field had been destroyed by the bait and many of the few remaining were de-

cidedly weak and would probably succumb within a day or two. Ten days after the demonstration was started, fully 99 per cent of the pests were dead. There was a very marked contrast between conditions obtaining at this time and those noted at the beginning of the demonstration. The cost of the materials was estimated at 13 cents an acre.

The work in this demonstration area was checked by observations in other fields, particularly in one or two representative areas, and it was most gratifying to note that in fields where the distribution was thorough, the results were as good or nearly as good as those outlined above. The oat field of Mr E. W. Peck, located a mile west of Meco, is particularly noteworthy. This was surrounded by large areas of grass which had been badly infested. The hay had just been cut and the grasshoppers, at the time of our examination on July 17th, were drifting into the oats in large numbers. The grain was luxuriant and stout and the seeding had made an excellent growth. On July 21st poison bait was sown in this field and the next day there was a heavy rain for two hours. An examination on the 23d, forty-eight hours after the distribution of the bait, resulted in finding a number of dead grasshoppers, and the next day three to nine dead insects could easily be found in twelve inches of a grain row. There was very little injury by insects either to the oats or the luxuriant seeding.

Practically as good results were obtained by a number of other farmers who used the bait according to directions. A very thin distribution, so scattering that it was difficult to find particles of the mixture, seemed to give better results than where more of the bait was used, and there was certainly much less danger of poisoning birds or other larger animals. The grasshoppers, as was shown by repeated observations, experienced no difficulty in locating pieces of bait the size of a grain of wheat or even smaller.

Injuries. Serious injuries the preceding year were reported by a number of individuals here and there in the Gloversville section, and an examination of representative areas last summer showed that the pests fairly swarmed in some places and had inflicted grave losses. There were certainly two hundred acres of oats, buckwheat, corn, rye and other grain in the vicinity of Gloversville which were either injured or liable to be seriously injured by the grasshoppers, and conditions obtaining here were representative of many other sections where the pests were numerous. The grasshoppers tend to collect in shelters of one kind or another and in a number of instances practically defoliated berry bushes. They invaded cornfields, establishing

themselves at the base of the leaves and fouling the fodder with their excrement. They even ate half through corn stalks an inch or so in diameter. There were a few cases observed where hunger compelled the insects to gnaw most of the bark from currant bushes.

The greatest damage was in the grain fields. Practically all the leaves were eaten from the rye and the insects attacked the heads, gnawing away one-fourth to two-thirds of the grain (Plate 2, figure 2), and reducing the yield to almost nothing. Oat fields, acres in extent, were invaded, the leaves stripped from the stalks and much grain lost by the insects feeding upon the heads and causing a shelling of from one-fourth to over half the crop. Occasionally almost nothing of value would be left in the field.

The injury to buckwheat was even more striking, most of the fields being surrounded by a strip of one to three or even ten rods upon which nothing green was permitted to grow. This was due to the young grasshoppers invading the field and devouring every vestige of the small plants so that the buckwheat was practically killed out. The pests seemed unwilling or unable to leave the shelter of the tall grass or hedge rows and live in the comparatively exposed buckwheat field, though occasionally large areas of buckwheat were entirely destroyed. The injury to this grain was apparently caused mostly by the young grasshoppers, though full-grown individuals were found in small numbers throughout the fields. A few typical cases of injury to grass and grain are given below.

Mr E. W. Peck has a large grass and grain farm a mile west of Meco, on sandy soil. The grass crop was reduced from one-half to two-thirds and possibly more, while in certain restricted areas almost nothing was obtained from fields which should have produced a fairly good crop.

A. Lasher & Son have a 400 acre farm near Union Mills, some 33 acres being in oats, 17 in corn and 15 in buckwheat. Mr Lasher stated that the yield of certain hay fields was greatly reduced; in one instance he obtained only two loads where he should have secured twelve. Many other instances of similar injury could be adduced.

Mr Frank Priester, a truck gardener of Saratoga, estimated the damage from grasshoppers on 17 acres amounted to $1000, most of which could have been averted by the judicious employment of a poisoned bait. Market gardens near Saratoga were very seriously affected, cauliflower and cabbage being destroyed, while asparagus stems and branches were peeled in part by the insects.

Mr George A. Saportus, also of Saratoga, had 30 acres of oats, one-half of which was destroyed by grasshoppers.

Limitation of the outbreak. This matter is of great practical importance in control work, since if there is a general flight and distribution of the pests, individual effort is of comparatively little value. It was noted at the very beginning of our investigations that the trouble was confined entirely, or nearly so, to sandy areas and the further our inquiries were pushed, the more data supporting this conclusion were obtained. A most striking instance of this limitation was to be seen along the State road from Gloversville to Broadalbin in the vicinity of the Skinner Creek valley. To the southeast of this road is a fertile, well-cultivated valley which last summer was practically free from grasshoppers, while on the northwest and extending almost to the road, was a series of low, sandy hills and generally sparse vegetation which fairly swarmed in places with grasshoppers. The line of demarcation was so sharp that hosts of grasshoppers could be found in some places within 200 feet of the roadway on one side, while practically none were to be seen upon the other. The same conditions, but on a much larger scale, obtained in the Mohawk valley. There were no signs of an unusual number of grasshoppers in the valley from Amsterdam west as far as St Johnsville, and in the latter locality inquiry from a number of presumably well-informed persons failed to disclose any knowledge of nearby infestations, though in the sandy region of Lassellsville, about 3 miles to the north of St Johnsville, millions of the pests were to be found. The same restriction, broadly speaking, was noted in Saratoga, Warren and Dutchess counties, and so far as we were able to learn, obtained in other sections where the pests were extremely abundant. In other words, there is a close connection between the sandy soil and sparse vegetation and an outbreak of local grasshoppers such as that which caused so much loss last summer.

Species destructive. The lesser red-legged grasshopper, Melanoplus atlanis Riley, was by far the most destructive species, and the evidence at hand, including earlier records, leads us to support the conclusion of Scudder [1] that this is probably the form which has been responsible for most of the earlier grasshopper injury in the eastern part of the United States. This pest is very similar to the more generally distributed and commoner red-legged grasshopper, Melanoplus femur-rubrum De G., the two forms differing in somewhat obscure structural characters and, to a marked extent, in prolificacy. M. atlanis, according to Scudder, has a very wide distribution, extending from the Atlantic to the Pacific and ranging north as far as latitude 50°, and on the Pacific coast extending to

[1] U. S. Nat. Mus. Proc. 20: 182, 1897.

the Yukon river. It is not found in the southernmost Atlantic states and most of California.

This pest winters in egg pods characteristic of many grasshoppers and normally hatches about the middle or latter part of May and, as shown by our observations of last summer, is particularly abundant in comparatively open, sandy regions where there is a relatively sparse vegetation. Wild or partly cultivated light soils appear to be particularly favored by this insect. According to the observations of Professor Somes in Minnesota, it is very likely to become abundant with a series of favorable seasons. The grasshoppers become mature from June 20 to the middle of July and from then till frost may be seen pairing. About the middle of August the deposition of eggs begins. A female deposits during the latter part of her existence, two to three and possibly four egg pods, a total of possibly one hundred eggs. Dry and rather firm soil is preferred for oviposition. Frequently large numbers of eggs are deposited within a very limited area, and upon their hatching in the spring the ground may be fairly discolored with the hosts of recently hatched grasshoppers. The young grasshoppers feed for a time in the immediate vicinity of their hatching places and very frequently, as shown by the conditions of the buckwheat fields, shelter in the fence rows and work into the young buckwheat to such an extent as totally to destroy the crop on the margins. Somewhat the same conditions obtain in mowings or pastures around spots where there is a heavy deposition of eggs. The feeding is sometimes so extensive as nearly to kill the grass. There is no evidence for supporting the belief that there is more than one generation in the north, though according to observations by Riley at St Louis, Mo., the first matured insects appeared July 12th, deposited eggs by the 20th and young hatching therefrom developed in 80 days. Bruner has also observed a second brood in the District of Columbia, the adults being smaller and darker.

The red-legged grasshopper, Melanoplus femur-rubrum DeG., is one of the commonest and most generally distributed of our species and is not readily separated from the lesser red-legged grasshopper, Melanoplus atlanis Riley. According to Bruner, it is a frequenter of low grounds, cultivated fields, shaded margins of woods, etc., where vegetation is rank and tender. It is rarely found upon dry hillsides or low adjacent meadows that fairly swarm with insects, a condition quite reverse of that which obtains with the lesser red-legged grasshopper. Collecting the past season resulted in practically none being found in association with the destructive species of the Adirondack foothills, though it was commonly present,

and in some instances abundant, in lower lying and better cultivated areas. According to Scudder, it appears to inhabit the entire United States and the settled parts of Canada, excepting only Alaska, and occurs south of our border as far as central Mexico. There are records, open to question, of this insect having been taken in Arctic America, Great Bear lake and Labrador.

The life history of this insect is practically the same as that of the lesser red-legged grasshopper and presumably, owing in considerable measure to its preference for low lands, unfavorable climatic conditions, enemies and parasites serve as fairly effective checks, and very rarely do we find the serious local injury recorded of the preceding species. Lugger states that it is favored by dry summers. This is probably due to the much greater relative freedom from fungous infection, a disease fatal to many grasshoppers.

These two closely related red-legged forms may be separated on general characters from each other, according to Prof. F. L. Washburn, as follows:

The general color is tan or yellowish brown and the larger part of the hind egs is marked by two distinct bars on the outer face, while the tip of the abdomen in the males always has a distinct notch. Lesser red-legged grasshopper.

The general color is reddish brown and there are no distinct dark bars on the hind legs. This species is usually smaller and shorter winged than the preceding. Red-legged grasshopper.

The two-striped grasshopper, Melanoplus femoratus Burm., is a large, yellowish brown form, easily distinguished when at rest by the rather distinct yellowish subdorsal lines. The young and newly transformed adults are greenish and the hind legs may be as red as those of the typical red-legged grasshopper. This species was associated in considerable numbers, perhaps 20 per cent of the whole, with the lesser red-legged grasshopper, Melanoplus atlanis Riley. Alone it would have been of comparatively little economic importance though it is a voracious feeder. The transformations of this insect are somewhat later than those of the lesser red-legged grasshopper, since nymphs were rather commonly present up to about the 20th of July. It is interesting to note that in Minnesota Professor Somes classes this as perhaps the most serious grasshopper pest in the state and adds that with a series of favorable years it becomes very abundant and causes great loss, especially where cereals are largely grown. The earliest oviposition noted by him was August 8th, and he cites one instance of having secured three egg masses from one female, the number of eggs in a pod varying from 39 to 82. In St Louis,

Riley records the first adults as occurring July 7th, eggs being deposited August 31st. Lugger states that this species prefers bottom lands and the edges of cultivated fields and other places with rank vegetation, and adds that although adults occur as early as the 10th of July, no eggs are deposited until late in August. This species succumbs to poisoned baits as quickly as M. atlanis. It is widely distributed throughout the State, as shown by the following records.

Pellucid grasshopper (Camnula pellucida Scudd.) This light brown, somewhat variable grasshopper was found in large numbers associated with Melanoplus atlanis Riley at Wells, August 3d, though collecting at Gloversville in July resulted in the capture of but one specimen. This species matures in Minnesota, according to Somes, the latter part of June and oviposits the last of August, the egg pods being rather short, stout, considerably curved and not firmly cemented. The eggs are placed just below the surface of the soil, among the roots of grasses or, in some cases, even above the surface in the dead grass. Individual pods contain from 20 to 30 eggs. This species has been recorded by Lugger as causing considerable damage in association with M. atlanis, and it is one of the forms held responsible for extended depredations in earlier years in California. It is considered to be partly migratory in habit and evidently disappears earlier in the season than M. atlanis. Like its associate in this State, it displays a marked preference for relatively wild areas and appears to be favored by dry seasons.

The Carolina grasshopper, Dissosteira carolina Linn., was associated in some numbers with Melanoplus atlanis and M. femoratus in the grasshopper outbreak of last summer, though it was rarely abundant enough to attract notice, except in the more open, sandy areas or along roadsides. This species is particularly likely to attract notice because of its large size and peculiar coloration. It is primarily an inhabitant of waste, sandy areas and the coloration is such that the insect, when at rest, harmonizes very closely with its surroundings, although when in flight the dark brown, yellow margined hind wings make it a conspicuous object. The males have a peculiar habit of rising into the air a few feet and vibrating the wings rapidly with a strange whirring or clacking sound; when engaged in this evolution, they resemble the hovering of the morning-cloak butterfly, Euvanessa antiopa Linn. The transformations of this insect are later than those of Melanoplus atlanis or M. femoratus, since adults were present in only very small numbers near Gloversville July 17th, while the stocky, grayish nymphs were numerous at that time. The latter part of July most of the young

had transformed to adults. This species, like its allies, winters in egg pods deposited in the earth, and it is probable that several pods are deposited by each female. The species is widely distributed throughout the State and rarely abundant enough so that it can be considered of much economic importance.

Control measures. Our studies of the grasshopper problem, at least so far as New York State is concerned, show an intimate relation between waste lands or a low type of agriculture land and serious depredations by these insects. The reasons for this in part, at least, is that the relatively scanty vegetation found in such places is unfavorable for the development of fungous diseases and consequently the pests escape a heavy death rate which would normally occur where the vegetation was more abundant. Second, the scarcity of food results in its rapid disappearance and the insects therefore become apparently more numerous than would be the case on good sodland, and if the grasshoppers be very numerous they are impelled by hunger to move from their scanty pasturage to other feeding grounds. Another important point worthy of recognition in this State is that, broadly speaking, the grasshoppers are local and drift or fly to only a comparatively limited extent. This has a practical bearing in that it means local efforts will not be nullified to any material extent by migration from adjacent fields. It is hardly to be expected that grasshopper invasions will result in the clearing up of some wild land poorly adapted to agricultural practices, though the recognition of the connection existing between the two will enable the farmer, wherever he be located, to estimate more correctly the probability of serious injury from these pests. A dry season, especially in May and early June, when the destructive grasshoppers are small, means that an unusually large proportion will attain maturity and cause more or less injury for the remainder of the summer, the effect being cumulative if these conditions prevail for several years in succession.

Destruction of eggs. Plowing to a depth of about eight inches is fatal to the egg masses and, where feasible, this is an excellent precautionary measure, though under most conditions obtaining in New York State, as we know them, we fear that this measure can scarcely be recommended for general adoption.

Destruction of young grasshoppers. Young grasshoppers, as pointed out above, frequently hatch in large numbers from limited areas and, of necessity, devour all the vegetation in and about their hatching grounds. The hatching of the lesser red-legged grasshopper occurs the latter part of May. The firm, sparsely grassed

sod of roadsides and along fences is a favorite place. Enormous numbers of the insects can be destroyed in such places with a blazing spray of oil, such as was extensively used in earlier years in the work against the gipsy moth. An ordinary hand-spraying outfit may be employed, using a nozzel extension, preferably iron, at least eight feet long and spraying crude petroleum. The oil is lighted after the apparatus is started and we have in this equipment a powerful and very efficient blast torch.

The experiments of Prof. F. L. Washburn, state entomologist of Minnesota, have shown that young hoppers can be destroyed by spraying the adjacent vegetation with the following compound: Sodium arsenite 3 pounds, water 180 gallons, molasses $1\frac{1}{2}$ gallons; or in reduced proportions, sodium arsenite 1 pound, water 60 gallons and molasses 2 quarts. The sodium arsenite should be dissolved in the water, the molasses added and the whole then thoroughly stirred. This costs only 30 cents an acre and may be applied with any fairly efficient spraying outfit. The dilution of the poison is such that it is not dangerous to either plants or stock if used as directed, though precautions should always be taken to prevent cattle from feeding freely in sprayed fields immediately after the treatment. This spray should be applied to a strip two to four rods wide around the area where the young grasshoppers are abundant or, if the infestation is not too extensive, to the entire field. In some instances where straw is convenient, it may be spread lightly over areas badly infested with young grasshoppers and then burned in the evening after the insects have taken shelter beneath it.

Hopperdozers, which are simply mechanical devices for collecting grasshoppers, have been extensively employed in some western states and are particularly successful in destroying the partly grown insects. The essential of a hopperdozer is a rather broad, shallow pan containing water with a little kerosene floating on its surface. This device is provided with screens or shields on the side and back in order to prevent many of the insects from hopping or flying over the machine while in operation and some arrangement is made for drawing it through the field. It may be pulled by hand or drawn by horses and can be used to best advantage only where the infested fields are moderately smooth. The sheet iron or heavy tin pans should be about four inches deep, some two feet wide and from four to fourteen or eighteen feet long, and in the case of the larger ones, water-tight compartments should be inserted every two feet or so, otherwise the water and kerosene will accumulate at one end or spill and the effectiveness of the device be greatly lessened. There should

be at the back a light canvas or oilcloth shield two to three feet high and held in place by braces. Runners are provided at each end, and in the case of the larger hopperdozers, several in between, the height of these varying from two to eight or ten inches according to the crop to be protected and the age of the insects to be captured. The oil quickly kills the pests and the collected grasshoppers should be removed as soon as the pans are well filled and more kerosene and water added, if necessary. The hopperdozer is particularly valuable in places where it is inadvisable to use poisoned baits.

Poisoned baits. This is one of the most effective and cheapest methods of destroying grasshoppers, especially after they have become nearly full grown. One great advantage of the poisoned bait is that under ordinary conditions it may remain effective for a week or ten days, killing insects most of the time and occasionally destroying others, because hungry grasshoppers have not hesitated to devour the remains of their dead associates. The very effective poisoned bait, mentioned above, is composed of 20 pounds of bran, 1 pound of Paris green, 2 quarts of cheap syrup, 3 oranges or lemons and $3\frac{1}{2}$ gallons of water. The bran and Paris green are thoroughly mixed while dry and if large quantities are to be used, it is important that the men preparing this protect the nostrils with a moistened sponge and avoid breathing the poisoned dust so far as practical. The juice of the lemons or oranges should be squeezed into the water and the remaining pulp and peel chopped fine and put in the water and the syrup added. The poisoned bran is then well dampened or mixed with this liquid. The addition of the lemons or oranges appears to increase materially the attractiveness of the bait. The mixture as prepared is moist and sufficiently mealy so that it can be sown broadcast in a field. The quantities given above are sufficient for five acres. It should be distributed preferably early in the morning and sown in as small particles as possible in order to secure the greatest efficiency and at the same time lessen the danger of poisoning birds and other animals.

The Criddle mixture is composed of Paris green 1 part, salt 2 parts, and horse droppings (preferably fresh) 35 to 40 parts by measure. It should be thoroughly mixed with enough water to make a soft though not sloppy paste and then distributed throughout the infested field. This was tried in some portions of the grasshopper-infested region and reported nearly as effective as the poisoned bait given above.

These poisoned baits are relatively cheap, the first named costing for materials and application only about 30 cents an acre. It is

perhaps needless to state that they should be applied in the early part of the outbreak, and if the work is well done results should begin to be apparent within twenty-four hours, and from then onward a gradual dying of the pests may be expected for a week or even ten days. Fowls and other domestic animals should not be allowed in fields where poisoned baits are distributed, for at least ten days or two weeks, though the probabilities at any time are against the larger animals getting sufficient poison to produce serious results, provided ordinary precautions are observed in the distribution of the bait. We would advise, if this material is used in cornfields, sowing it in such a way that very little or none will drop onto the leaves and perhaps lodge at the base of the leaf sheathes; otherwise there is a possibility of poisoning animals with the fodder later. Too much care can not be exercised in looking after all the containers used for the bait, since the grain and sweetening are very attractive to animals.

NOTES FOR THE YEAR

The following observations relate to some of the more injurious or interesting species coming to notice during the year and are grouped as heretofore, under appropriate subheads.

FRUIT INSECTS

Apple tent caterpillar (Malacosoma americana Fabr.). There was a general and, in many localities, a serious infestation by this common, conspicuous and easily controlled pest. The plague extended from Long Island north to Clinton and St Lawrence counties and west to Chautauqua county. There was less injury in some localities than during the previous year, though wild cherry trees were frequently stripped and many apple orchards not given the best of care were severely injured or defoliated. The caterpillars were hardly seen in well-sprayed orchards.

This common insect winters, as is well known, in dark-brown egg belts deposited on the smaller twigs of wild cherry and apple, in particular. The caterpillars are fully formed in the fall and remain in the eggs over winter, issuing with the first warm weather and attacking the unfolding leaves. The gregarious habits of the pests and their conspicuous nests render their early detection easy.

It is entirely practical to forecast the abundance of this leaf feeder by looking for the egg masses during the winter. Collecting and burning of these may be advisable in the case of small trees, though the caterpillars, either small or nearly full grown, succumb quickly to such a poison as arsenate of lead used at the rate of 2 pounds to 50 gallons of water. Good spraying should give results in twenty-four to forty-eight hours, unless the caterpillars are so nearly full grown that they will stop feeding rather than eat the poisoned foliage. Wild cherry is a preferred food plant and a prolific source of trouble for adjacent apple orchards. This comparatively worthless tree should be kept cut down so far as practical and thus reduce, in large measure, the probability of a recurrence of such outbreaks as that of last year. This species is so easily detected and so readily controlled that there is no good reason why it should be allowed to become excessively numerous, except possibly in those sections seriously handicapped by extremely low land values.

Burning the nest with a torch is comparatively inefficient, since many of the pests are likely to escape and there is danger of severely injuring the limbs. It is simpler and more satisfactory to remove

the nests with a small, conical brush on the end of a light pole, or an ordinary bamboo pole with the tip slightly roughened can be used almost equally well. All that is necessary is to bring the end of the pole in contact with the lower portion of the nest and then with a twisting and elevating movement roll the nest and its contents around the end of the pole. This, if carefully done, will result in removing practically all the caterpillars with the nest. The latter should of course be crushed or otherwise disposed of so as to destroy the inhabitants.

Ten-lined inch worm (Erannis tiliaria Harr.). An outbreak by this rather common caterpillar was reported from Oliverea, Ulster county, by Mr R. F. Pearsall, who stated that the pest was very destructive to both orchard and woodland trees. It was associated with the spring canker worm in defoliating maple and elm trees near the village of Greenwich, according to a report transmitted by Principal C. L. Morey. This occasionally injurious form nearly defoliated an orchard at Munnsville, Madison county, in 1899.

The caterpillar is easily recognized by its orange head and yellowish body, the latter marked dorsally with a series of ten fine, somewhat broken, wavy, black lines. It becomes full grown about the middle of June and has a length of one and one-fourth inches. The pests then desert the trees and transform to pupae in earthen cells some five or six inches below the surface, the moths issuing late in October or early in November. The female is wingless and has a yellowish body sprinkled with black dots, while the male has a wing spread of nearly two inches, the forewings being a rusty buff sprinkled with brown spots and with two wavy, brown lines, the inner one often indistinct. There was a considerable flight of this moth in Albany October 21st, in association with the cotton moth, Alabama argillacea Hübn., and it is probable that this insect was equally, if not more, abundant at Kingston, since specimens were received from Dr J. R. Gillett of that city. The caterpillar of this species, like the allied much more common and destructive canker worms, can be easily destroyed by early and thorough spraying with a poison, such as arsenate of lead, using 4 pounds or even more to 50 gallons of water.

Green fruit worm (Xylina antennata Walk.). Adults of this species were received the latter part of March and early in April from Mr E. B. Jansen, Kingston, and the indications are that we narrowly escaped an outbreak by this insect upon soft maples comparable with that of 1898, or the more extended defoliations of 1911. Caterpillars of this species are also known as green

fruit worms and occasionally cause serious injury in orchards by gnawing holes in the small fruit. Observations in apple orchards at both Poughkeepsie and Bangall the latter part of May showed these pests to be unusually abundant, and in an orchard at Kinderhook small pear trees only three years old were rather commonly infested with four or five caterpillars. The pests were so numerous in this latter case as to cause an appreciable amount of injury to the foliage.

Observations of Professor Herrick in 1913 showed that these moths fly in very early spring and deposit their whitish or flesh-colored, ribbed, flattish globose eggs singly in scars, especially leaf scars on the branches. The larval habit of eating into the young fruit makes it difficult to control this species satisfactorily by ordinary spraying, though as a rule the pests are not very destructive in well-sprayed orchards.

Pear thrips (Euthrips pyri Dan.). This new and minute insect pest has been very injurious locally here and there in the Hudson valley. On May 12th we examined a pear orchard at Clarksville of some 1000 trees which, we were informed, bore a full crop last year and showed nothing in the way of blossom blight. The Seckle and Bartlett pears were badly injured, one-half to three-fourths or even more of the blossoms being blighted. The Kieffers were practically free from the trouble and were just breaking into bloom. A most remarkable condition was observed the latter part of May in a small pear orchard at Bangall. The trees, mostly Seckles, were very badly infested and the damage was so pronounced in the case of a number as to result not only in the blasting of the blossoms, but the destruction of the young leaves so that the upper half of the trees was practically bare, while the lower branches were in fairly good foliage. The crop of Seckle pears in this orchard was practically ruined and there was a serious reduction in the yield of the Bartletts. A larger pear grower near Hudson reported an estimated loss of 300 barrels of Seckle pears. Mr William Albright of New Baltimore considered that the pest had been unusually injurious, owing to the cold, backward weather holding the buds in check and giving the thrips an extended opportunity for work. The injury was confined mostly to the Seckles and he noted a marked restriction of the infestation to trees standing in low places or under a hill. He also observed an abundance of thrips on certain apple trees, having counted as many as 19 in one blossom. A pronounced limitation to certain localities or portions of orchards continues to be a feature of attacks by this pest, and in the case of the Clarksville orchard it would appear as though there may have been a some-

what marked invasion by flight or drifting with the wind, otherwise the serious injury of one season could hardly be preceded by almost complete immunity the previous year.

The most evident signs of the insect's presence are the sticky buds, the brown, blasted appearance of the blossom buds and the unusual drop of bud scales followed later by small, crinkled, spoon-shaped leaves. In the earlier stages of the attack a slender, dark brown insect only one-twentieth of an inch long may be seen upon the opening fruit buds and especially in crevices between the stems of the partly expanded fruit clusters.

Badly infested orchards should have the lime-sulphur spray for San José scale delayed until the buds have started and then add to this preparation a tobacco extract, such as black leaf 40, 1 to 800. This will destroy many of the thrips before they have had an opportunity to find shelters in the buds which have opened just sufficiently so that the insects can make their way down between the stems of the young fruit. Later, if the thrips are numerous, it is advisable to spray with a tobacco extract, at the above given strength, to which have been added 4 to 6 pounds of soap, just as soon as the young pears have separated sufficiently so that the insects at the base of the fruit stems are exposed. This spray, in particular, should be directed so that the insecticide will be driven down into all crevices of the fruit clusters. Another treatment with the tobacco extract and soap may be advisable after the blossoms fall. This insect works so rapidly and seeks shelter so persistently that timeliness is a prime essential in control work.

Pear midge (Contarinia pyrivora Riley). Although this insect became established in this country about 1877 and its dissemination has been recorded in more or less detail, records of serious injury are comparatively few. It has been known in southern Albany county for a number of years. It appears to thrive on the heavy lime soils of that section, and last spring, according to the statement of Mr Robert McHench of Clarksville, was responsible for the destruction of probably 90 barrels of pears, the pear thrips blasting an equal amount of an estimated crop of 200 barrels. Under ordinary conditions the pear midge would not have been particularly injurious, the destroyed fruit representing a rather severe and somewhat desirable thinning. It is interesting to note in this connection that this insect (and the same is true of the pear thrips) appears to be unknown on the light soil of the extensive pear-growing region of Kinderhook and vicinity. A summary account of the pear midge is given in the report for 1912, N. Y. State Museum Bulletin 165, pages 97 to 99.

Pear psylla (Psylla pyricola Forst.). This pest has caused an unusual amount of damage in some Hudson valley orchards this year and certain growers seem to have overlooked the fact that it is nearly as important to take care of hibernating shelters near trees, as to destroy the insects which may be wintering upon the trees. Stone walls, piles of brush, hedge rows along fences, all afford satisfactory hibernating quarters for the hibernating psyllas or "flies," and the proximity of such shelters almost invariably means serious injury to orchards.

Repeated tests with delayed applications of the lime-sulphur wash used at winter strength have given very satisfactory results in the control of this insect. Similar treatment with a miscible oil appears to be equally or perhaps a little more effective. The important point in such work is to delay the application until the psyllas have deposited most of their eggs. This time coincides very closely with the breaking open of the blossom buds; the spraying should be done just before this occurs.

Practical tests last season with a midsummer spray of black leaf 40, using three-fourths of a pint to 100 gallons of water and 4 to 8 pounds of soap showed that it was possible to check severely, if not entirely to destroy the insect. Wherever some eggs and adults escape such treatment, a second spraying should be given within a week or ten days.

Banded grape bug (Paracalocoris scrupeus Say). Observations upon this species, noticed in some detail in the report for last year[1], were continued the past season by Mr L. F. Strickland, horticultural inspector of the State Department of Agriculture, and through his cooperation we secured material from which detailed descriptions of the immature stages were prepared. The following observations upon the habits of this species were kindly placed at our disposal by Mr Strickland.

The first bug was observed May 21st, the second May 25th, and hatching was evidently completed by the 27th. According to observations by Mr Strickland, the first molt occurred from May 27th to 30th, the second from May 28th to June 4th, the third from May 30th to June 8th, the fourth from June 4th to June 10th, and the fifth from June 6th to June 17th, adults being found from these two latter dates until June 28th, the last bugs being seen on rosebushes on the last named date. He also observed this species repeatedly on apple foliage.

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[1]N. Y. State Mus. Bul. 175, p. 41–44, 1913, 1915.

Field observations by Mr Strickland show that the first and second stage nymphs have the same color characteristics except that in the first stage the color is a light greenish yellow and the banding of the legs and antennae less conspicuous. The third and fourth stages are colored nearly the same, the bodies being red with a light streak down the back, while in the fifth or last nymphal stage the insects are green, changing to brown with a light streak down the back, the antennae and legs being banded in each case.

Below are given more detailed descriptions, those of the younger stages being drafted from alcoholic material, while the later stages were described from living material.

First stage. Nymph 1.5 mm, a pale greenish yellow, the eyes, red, the antennae fuscous yellowish, rather indistinctly banded; the basal half of the second and third, and the distal fifth of the third antennal segments whitish, the fourth pale yellowish; legs pale yellowish; tibiae with a narrow basal band, a moderately broad band near the basal third and the distal third white; basal half of the tarsi white.

Second stage. Length 2 mm, coloration nearly as in the preceding stage, except that it is mostly a greenish and the darker bands of the second and third antennal segments are yellowish red or reddish, and the banding of the legs yellowish brown or brownish.

Third stage. Length 2 to 2.75 mm, antennae mostly a rich dark brown, except for the white banding and the terminal segment which are as given above. Eyes reddish; body a variable reddish with a rather distinct median whitish line, the apical portion of the abdomen yellowish. Legs mostly dark brown, the anterior and mid tibiae with the basal third reddish brown and divided by a narrow, white line, the distal two-thirds mostly whitish, each third marked apically with an obscure yellowish or reddish brown band; tarsi fuscous yellowish with an obscure whitish band near the middle; posterior tibiae with a distinct broad, white band near the basal third and the entire distal third whitish, the tarsi yellowish basally, fuscous yellowish apically and with a broad, white band in the middle.

Fourth stage. Length 3 to 3.5 mm, much as in the second stage, except that the body is somewhat greener and the wing pads slightly fuscous just at molting. The specimens show a distinct, irregular, median, light greenish area extending from the base of the head to and including the base of the abdomen. The dorsum of the head and lateral portions of the thorax reddish purple, the abdomen mostly mottled with deep red, each segment posteriorly with a row of six irregular, whitish spots. Color of antennae and legs practically as in the preceding stage.

Fifth stage. Length 4 mm. This differs from the preceding in the dorsum of the head, the lateral portions of the thorax and the wing covers being a dark brown, the median area whitish green. The dorsum of the abdomen is somewhat darker, with the transverse rows of irregular, circular spots more distinct and pale green. Coloration of the antennae and legs practically as in the preceding stage.

Observations by Mr Strickland on May 27th showed a general infestation, counts of groups of check vines resulting in finding 22, 6 and 27 bugs on 7, 6 and 8 vines, respectively. The young bugs were then working in the tips of the shoots, the latter being about 6 inches long. The vines were sprayed with black leaf 40, three-fourths of a pint to 100 gallons of water, to which were added 5 pounds of laundry soap and 6 pounds of arsenate of lead. The application was made to two rows of 99 vines, the infestation of the checks being given above. The following day 12 bugs were found on 7 vines in one of the rows, 11 bugs on 6 vines in the second row, and 9 bugs on 8 vines in another vineyard, which had been sprayed with this formula, the original infestation being 55 and 32 bugs to 21 vines. The spraying resulted in the destruction of over 58 per cent of the pests. There was a general migration of the young bugs from the tips at about the time the cluster sheaths had broken on June 1st, and another spraying was given at this time with the above-designated materials, with the result that no bugs were found on a continuous series of 6 vines in one row, and only 5 on a similar series in another, the infestation in the latter case being confined to two vines.

Tabulation of results of spraying for cluster infestation

ROW	2	3	5
Vine 1	0	0	0
2	0	0	0
3	0	0	1
4	0	0	0

The vines, it will be seen from the table given above, were practically free from the pests after this last spraying. On June 17th many of the berries were observed dropping from the clusters, which were uneven as in the preceding year. Mr Strickland finally concluded that this dropping of the immature grapes may have been

caused by a weak pollination rather than as a result of insect injury. There is, nevertheless, a probability of some injury resulting from the presence of these insects. The biological data given above are of value in indicating what may be possible with allied species on other fruits, even if this form is not a serious enemy of the grape, and the facts are therefore placed on record.

Spotted winged Idiocerus (Idiocerus maculipennis Fitch). The recently hatched nymphs are small, shining, brownish black and only about one twenty-fifth of an inch long. They were active and abundant on apple trees at Arlington May 14th, though they did not seem to be causing any particular injury. About ten days later the nymphs were still abundant in the field, though in the second stage. At this time the orchard was being sprayed for the control of the red bug and it was noted that these nymphs appeared to be much less susceptible to the insecticide. By June 25th the nymphs had attained the adult condition, and by July 8th they were rather common in the orchard and numerous nymphal skins were seen here and there on the leaves. There was no injury which could be definitely associated with the species. Both nymphs and adults are active and not readily captured.

Messrs Osborn and Ball [1] state that this species occurs very commonly on hawthorn and crabapple trees, the larvae appearing in May. The earlier ones mature by the middle of June and later individuals early in July. The adults were reported by them as common the latter half of June and nearly through July, and as again common the last of August and early in September. This latter would suggest the possibility of a second brood. These authors have figured both the adult and nymph of this species.

San José scale. The appearance during the summer and fall of 1913 of hosts of small, four-winged parasites aroused a lively interest among fruit growers and led many to hope that at last we had a thoroughly effective natural check for the San José scale. Investigations and observations of last year showed these beneficial species, notably Prospaltella perniciosi Tower and Aphelinus fuscipennis How., to be widely and generally distributed and the more important species in this beneficial work, though Coccophagus immaculatus How. and several associated forms were obtained in smaller numbers.

Observations upon the San José scale and its parasites have been continued during the past season and early in July a circular letter

[1] Davenport Academy Natural Sciences Proceedings, 8: 73, pl. 3, fig. 4, 1898.

was sent to several hundred representative fruit growers in different sections of the State, requesting their cooperation in securing data relative to the prolificacy of the San José scale and the evidences of parasitic control, attention being particularly directed to the condition of unsprayed orchards and the relative abundance of the pest as compared with earlier years. Reports from residents of the Hudson valley, especially that portion south of Albany and north of Newburg, resulted in our learning of a number of unsprayed orchards which had not been seriously injured by San José scale. A few similar reports, though relatively by no means so many, were received from the western part of the State. The reason for this discrepancy is probably due to the fact that in these larger orchard areas it was easier to prevent San José scale becoming well established and, as a consequence, general conditions were not so favorable for the establishment of the parasites. There are probably several factors involved in the comparative immunity from this pest. The scale does not thrive so well on trees in a relatively poor condition, as they usually are in unsprayed orchards. Nevertheless, observations in the towns of Schodack and Stuyvesant and in the vicinity of Poughkeepsie resulted in our finding orchards where the parasites had evidently been numerous and important factors in checking the pest in 1913 and were continuing their beneficial work to some extent, at least, the past season. Dr Harvey Losee of Upper Red Hook reported under date of July 22d, to the effect that the scale had been diminishing for the past three years to such an extent that it could now be scarcely found on unsprayed trees. He referred to some young Ben Davis trees, a variety particularly subject to attack, and stated that five years ago they were badly infested while at the present time they are as clean and thrifty as well-sprayed trees. It is possible that some other factor besides parasitic activity has been important in checking the pest in this particular case.

It is yet early to estimate the true value of these small parasites, since in order to be effective they must be numerous for a series of years and demonstrate their capability, in orchards in first-class condition, of keeping the San José scale within reasonable bounds. Spraying with a lime-sulphur wash has become so habitual with most progressive fruit growers, and the benefits from this operation have been so manifest, that there is little likelihood of there being a suspension in this practice for the purpose of giving the natural enemies a chance, and until this is done it will be nearly impossible to approximate the full value of these tiny allies. The incidental benefits resulting from the lime-sulphur application are, in our esti-

mation, more than sufficient to cover the cost of the treatment and for the present, at least, we would advocate a continuance of the spraying without regard to parasites. These insects, if they are destined to have an important effect upon their hosts, will gradually become more abundant in the smaller, unsprayed orchards, and here we may expect them to render the most effective service, since it is relatively more costly and difficult for the owner of a few trees to spray.

GRASS AND GARDEN INSECTS

Grass webworms (Crambus luteolellus Clem.). Last June several complaints of severe injury accompanied by specimens were received from F. H. Lacy, agent of the Dutchess county farm bureau. The larvae were identified as the above-named species, and upon examination it was found that they had practically destroyed 25 per cent of the crop in a two-acre field, the damage being most evident on the lighter knolls. There was also serious injury reported from Pine Plains.

Grass webworms live by preference upon grasses and ordinarily their depredations in cultivated fields are limited to portions adjacent to mowings or pastures. The parent moths fly but a short distance as a rule, generally alighting within a rod or two. The eggs are dropped indiscriminately on the ground, the young caterpillars feed for a time, winter about the roots of grasses in a half-grown condition and then complete their development the following June. Occasionally as many as thirty caterpillars may be found in one hill of corn, mostly at the base of the stalks, and under such conditions a crop is out of the question. The full-grown larvae are dull whitish or purplish with a darker head and attain a length of about three-fourths of an inch.

This species may be distinguished from associated forms by the darker markings of its yellowish head, the approximate submedian tubercles of the abdominal segments with their inner margins truncate and the peculiar projection of the suprastigmatal tubercle obliquely below and behind the spiracle. A detailed description is given below.

Larva. Length 1.5 cm. Head a yellowish amber, mottled with brown, the thoracic shield fuscous yellowish and the body a light grayish yellow with slightly darker tubercles.

The mottling of the head is irregular and varies from light to dark brown, there being a tendency toward the formation of irregular, rectangular spots. Laterally the head is ornamented with rather

long, stout, sparse setae. The antennae are biarticulate and short, the segments being broader than long. The labrum is reddish brown, the thoracic shield has a median, paler line and the second and third thoracic segments dorsally have a pair of submedian, bisetose, oval tubercles on the anterior annulus, and a transverse median tubercle on the posterior annulus, that on the third segment being partly divided. The abdominal segments have submedian, subquadrate tubercles, the anterior ones as wide as the annulus and unisetose, the posterior ones narrower, longer and with the seta near the lateral fourth, both tubercles being almost truncate mesially. Above the suprastigmatal line there are two irregular tubercles, the one on the anterior annulus unisetose, irregularly ovoid and with an almost divided extension obliquely below and behind the spiracle; that on the posterior irregularly fusiform and with the long axis slightly oblique to the vertical axis of the body; the ninth abdominal segment with a median, compound, narrowly ovoid, polysetose tubercle; the suranal plate covering most of the tenth segment and with a number of irregularly placed setae; true legs pale yellowish transparent; prolegs whitish, the rows of minute claws dark brown.[1]

There is no very practical method of fighting these pests, owing to the fact that usually severe injury is caused before their presence is suspected and then it is too late to do much to protect the remainder of the crop. In localities where these pests are likely to be abundant it is advisable to keep corn and other crops liable to attack, at some distance from grasslands and to avoid planting upon recently turned sod. Plowing land infested by these insects in late summer or early fall, say August or early September, should result in most of the caterpillars perishing before the following spring. If this be impractical, spring plowing should be delayed as late as possible so as to give the caterpillars a chance to complete, so far as practical, feeding before the sod is turned under. The planting of an extra amount of seed would assist to some extent. There is a better chance of the crop outgrowing the injury if it be upon well-manured, highly cultivated land.

Yellow field ant (Solenopsis debilis Mayr?) The latter part of June a complaint was received from Ernest W. Conklin of Salt Point, through F. H. Lacy, agent of the Dutchess county farm bureau, to the effect that recently planted corn seemed to be growing smaller and was troubled with an ant eating the heart out of the

[1] Insects of Illinois, 23d Rep't, p. 154, 1905. Professor Forbes gives here a key for the separation of webworm larvae likely to be found injuring corn.

kernels. An examination July 16th showed that a small yellow ant, presumably the above-named species, had excavated the interior of kernels of corn here and there, scattering the granular remains about in the soil and leaving the outer shell or coat of the kernel nearly intact. This type of injury was much less prevalent than damage by grass webworms described elsewhere, and as a rule it is not serious and is rarely reported. The only published records of this character are those by Doctor Forbes, state entomologist of Illinois. The development of the corn is arrested and, as noted above, the plants may even seem to grow smaller.

In localities where this field ant is numerous and liable to cause damage in the above-described manner, we would suggest tarring the corn and adding thereto a poison such as Paris green or arsenate of lead. In experiments recently conducted in Massachusetts, gas tar was diluted with linseed oil until rather thin and the seed tarred and then coated with road dust and Paris green mixed in such a proportion that the corn after being shaken up in a bucket showed a greenish color. This protective coating will probably prevent the ants attacking the seed until growth is so well started that comparatively little harm would result. Corn treated in this manner can be sown with a planter.

Say's blister beetle (Pomphopoea sayi Lec.). The soft blister beetles have a somewhat characteristic shape and are usually dull colored. This, the largest of our native forms, is nearly an inch long and is easily distinguished from its allies by its rather stout, olive green body and the shining black, orange-banded legs. It was unusually abundant and injurious in the vicinity of Albany the latter part of May and early in June, having been reported from such widely separated localities as Port Jervis, Feura Bush, Rensselaer, Canajoharie and Little Falls. The records of 1909 indicate that these beetles may be found the latter part of June and early in July. The Rensselaer outbreak was marked by the appearance of hosts of the insects in an acre of beans, the crop being threatened with destruction by their feeding upon the blossoms. The species had been comparatively rare until recent years. It was brought to our attention first in 1900, and in 1909 and 1911 there were numerous rather local outbreaks. The beetles occur in swarms and display a marked preference for locust blossoms. The outbreak lasts only about a week and, as a rule, the results are not serious. The beetles have also been recorded as feeding upon peach blossoms, wheat and the leaves of butternut. The grubs feed upon grasshopper eggs and the probabilities are that the species is decidedly beneficial on the whole, even though

occasional local depredations are committed. It is possible that the insects could be driven from valued fruit trees by the use of long switches, jarring or even the employment, when weather conditions are favorable, of a dense smoke. It is better to attempt some such method than to destroy the beetles by hand picking or the use of poisons. The latter can not be used with safety upon trees in bloom, to say nothing of its being against the law.

Juniper plant bug (Chlorochroa uhleri Stal.). This large, olive green stink bug with pinkish markings is easily recognized and usually rare, though in June 1894 it was reported from Brockport as having nearly destroyed a crop of peaches. Several years ago the writer was surprised to find some eight or ten of these striking bugs on a small pine tree at North Chatham, and the past summer reports of the unprecedented abundance of this insect, accompanied by serious injury, were received from Miss M. A. Soule, Quaker Street, Schenectady county. Miss Soule states that the bugs were so thick that the sunflower seeds were practically destroyed (hundreds being on one head). They injured green corn and blasted small peas while still within the pods, the insects evidently piercing the pods and drawing the sap direct from the seeds, thus preventing a normal development. Tomatoes were also injured and turned black at the point of attack within a few days, fully half the crop being affected. Quantities of currants and black berries were likewise spoiled. Others in that section were similarly troubled, it was stated.

Miss Soule kindly forwarded a number of living bugs and we were able to verify her reports so far as corn and tomatoes were concerned. The insects repeatedly established themselves upon the surface of a tomato, and after a time the slender, chitinous lancets were forced into the fruit to their full extent, the ensheathing labium folding back near its middle as the head is pushed down, until the lower margin touched the surface of the fruit. One bug remained over a feeding puncture twenty-seven minutes, repeatedly raising and lowering its head as it partly withdrew or forced the lancets into the fruit. When the latter occurred, the lancets were supported only by the tip of the labium and the tissues which they pierced. The next day the fruit would show an oval, slightly sunken area about one-fourth of an inch in diameter, the center being marked by a minute puncture. This injured spot became more visible the second day, and later exhibited some discoloration. A similar injury was also observed to kernels of sweet corn in the milk.

The Juniper plant bug was by far the most abundant species concerned in this injury, though a related form, Euschistus

variolarius Pal. Beauv., was present in much smaller numbers and was observed feeding upon both corn and tomatoes. This insect apparently experienced less difficulty in piercing the skin of the tomato, though it did not drive the lancets so deep into the fruit as to necessitate the folding of the labium.

Such outbreaks are very unusual and can ordinarily be controlled best by systematic hand picking, such as jarring the bugs into a shallow pan containing water and kerosene.

Iris borer (Macronoctua onusta Grote). Specimens of this borer were received under date of August 12th last, from Mrs C. H. Van Orden of Catskill, accompanied by the statement that the pests were working havoc in an Iris bed and making a clean sweep of the plants. A detailed account of this insect was published by the writer in the 27th report of this office, Museum Bulletin 155, pages 52 to 54, and since this notice appeared the investigations of Mr A. F. Winn,[1] Westmount, Quebec, have shown that the greenish eggs of this species are deposited in the fall. The moth was observed to lay her eggs in the long crack of one leaf and also between the edges of overlapping leaves where they probably remain unhatched until spring. Mr Winn describes the egg as pale greenish, turning in a few days to purplish. It is much flattened on the top and bottom and shaped somewhat like a vest button. The transverse diameter is .6 mm and the vertical diameter .27 mm. It is marked with shallow ribs which are most evident on the rounded sides. Winter burning of the debris on Iris beds, if this can be done without injury to the roots, is the simplest and most effective method of keeping this pest in check since, as shown by these observations, it must result in the destruction of the hibernating eggs.

ORNAMENTAL AND SHADE TREE PESTS

European hornet (Vespa crabro Linn.). The white-faced hornet of America, Vespa maculata Linn., is well known because of its large size, bright contrasting markings and the very large, nearly globular, paper nests rather commonly seen hanging from the eaves of buildings or the branches of trees. The European representative (Plate 2, figure 3) of this hornet is even larger, has become well established in southern New York and throughout New Jersey, and during the last few years has attracted notice because of its gnawing off the bark from the small branches of various trees, especially birch (Plate 2, figure 4).

[1] Canadian Entomologist, 46: 296, 1914.

This giant hornet is hairy, black, with dark, yellowish orange markings, the posterior extremity being mostly yellowish orange. It is about an inch long. Gillanders records injury by this insect in England to the young stems of ash, alder and elm, while Judeich and Nitsche, writing of German conditions, report it as stripping the bark from alder, linden, lilac, various willows, poplar, horse-chestnut, larch and oak.

The injury to the living twigs is usually very irregular in character and generally inflicted early in June or during July. It is caused by the hornets gnawing away the bark down to the sapwood, attacking twigs half an inch in diameter or less. The denuded area may be mostly on one side of the twig and extend for 10 to 12 inches, or it may be much more irregular and girdle the twig in several places. In the latter instance the portion beyond the affected part ultimately dies; in any event there is more or less disfiguration. The tissues removed are doubtless used in the construction of the paper nests, though some European authorities hold that the main purpose of this attack is to obtain the sap flowing from the wounds.

The life history of this species is very similar to that of our native Vespa maculata Linn., except that the nests are rarely found hanging free, being more generally built within cavities in a tree, in confined places in buildings, as between rafters and underground. The nests in trees may consist of a series of combs occupying the entire cavity, entrance to which is usually gained through a small opening. The underground nests are entered by a broad gallery which, turning up slightly at its extremity, gives access to the lower portion of the nest. The "paper" used in construction of the nest is considerably darker than that made by Vespa maculata.

Control measures. Ordinarily we would not expect serious injury to follow attacks by these hornets and, taken as a whole, it is probable that they are more beneficial than injurious. The damage to specimen trees in lawns and parks is certainly annoying and can be prevented only by reducing the number of the hornets or by applications of protective materials to the trees. The European authorities mentioned above suggest trapping the hornets by the use of long-necked flasks containing sweetened water. It is also practical to trace the insect, especially in early morning or on cool days, and thus locate the nest, which may be destroyed by the use of burning sulphur or carbon bisulfid, depending upon its location. This can be best done in the early evening, and great

care should be exercised to prevent the escape of the insects during the treatment and possible serious results to the operator, since the sting of this species is very painful.

The writer has suggested that more valued trees might be protected from attack, to a large extent at least, by spraying the branches with a poison, such as arsenate of lead used at the rate of at least 4 pounds to 50 gallons of water and adding thereto 3 to 4 pounds of soap. There would be a fair chance of the insects succumbing to the poison if the application was not sufficiently distasteful to ward off the hornets.

Elm leaf beetle (Galerucella luteola Müll.). The elm leaf beetle continues to be a serious pest of elms, particularly the European varieties, though the damage of the last few years has not been nearly so general as during the preceding decade, partly because of more general and thorough spraying. An interesting development the past season was the discovery by Prof. M. W. Blackman, State College of Forestry, Syracuse, of a well-established local infestation of the elm leaf beetle. Some years ago a few insects were received from Oswego and since then no additional spread has been recorded in that section. It is only a question of time, as has been repeatedly stated in other publications, when this pest will probably become well established and be decidedly injurious in most of the important cities and villages of New York State, aside possibly from some localities lying at high elevations or where climatic conditions are so rigorous as to prevent the pest multiplying freely.

In the report for 1912 [1] we called attention to the influence adverse weather conditions in mid-June had upon an apparently vigorous generation which threatened serious and widespread injury to the elms. Observations at that time showed that this period of abnormally cool weather came at a time when oviposition should have been at its height. Somewhat similar conditions prevailed in the vicinity of Nassau, at least, last June, and a study of climatic conditions based upon the records of the United States Weather Bureau revealed an interesting correlation between arrest in the development of this insect and unseasonable cool weather. Owing to the fact that more detailed observations were made upon the development of the beetle at Nassau, the weather records for Chatham, less than 10 miles distant and the nearest recording station, were utilized. Earlier studies show that under normal

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[1] N. Y. State Mus. Bul. 156, p. 48.

conditions oviposition by the elm leaf beetle begins the latter part of May and continues throughout June, being at its height in the middle of the month. The month of June was therefore divided into three ten-day periods and the maximum, minimum and effective temperatures tabulated for the past decade, namely, from 1905 to 1914. In one series of tabulations 43° F. was taken as the biological zero, and in the other 55° These tabulations are given below.

Tabulation of maximum June temperature units, 55° = 0

Days	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	Average
1–10	185	287	110	257	175	101	192	182	191	215	189.5
11–20	280	231	257	255	209	219	213	189	254	199	230.6
21–30	215	272	309	305	296	272	221	279	287	234	269.0
Totals	680	790	676	817	680	592	626	650	732	648	689.1

Tabulation of minimum June temperature units, 55° = 0

Days	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	Average
1–10	—64	+31	—97	—46	—38	—143	—33	—60	—70	—10	—53
11–20	+61	—26	—36	—16	—24	+14	—8	—50	—22	—55	—18.2
21–30	— 5	+26	+44	+43	+57	+26	+1	+16	+34	+16	+25.8
Totals	— 8	+31	—89	—19	— 5	—103	—40	—94	—58	—49	—43.4

Tabulation of effective June temperature units, 55° = 0

Days	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	Average
1–10	121	318	13	211	137	—42	159	122	121	205	136.5
11–20	341	205	221	239	185	233	206	139	232	144	214.5
21–30	210	297	343	348	353	298	222	195	321	250	283.7
Totals	672	820	577	798	675	489	587	456	674	599	634.7

Tabulation of maximum June temperature units, 43° = 0

Days	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	Average
1–10	305	407	220	377	295	221	312	302	311	335	308.5
11–20	400	351	377	375	329	339	333	309	374	319	350.6
21–30	335	372	429	425	416	392	341	299	407	324	373.8
Totals	1 040	1 130	1 026	1 177	1 040	952	986	910	1 092	978	1 033.1

Tabulation of minimum June temperature units, 43°= 0

Days	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	Average
1-10	58	151	27	80	82	33	87	70	67	110	76.5
11-20	169	101	84	104	98	134	113	75	95	73	105.5
21-30	115	146	186	163	177	146	121	135	154	137	148.0
Totals	342	398	297	347	357	313	321	280	316	320	329.1

Tabulation of effective June temperature units, 43°= 0

Days	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	Average
1-10	363	558	247	457	377	254	399	372	378	445	365.0
11-20	569	452	461	479	427	373	446	384	469	392	425.2
21-30	450	518	615	488	593	538	462	434	561	561	522.3
Totals	1 382	1 528	1 323	1 424	1 397	1 165	1 307	1 190	1 408	1 398	1 352.7

Cool weather the first ten days in June, so far as conditions at Nassau and the elm leaf beetle are concerned, is very likely to be a continuation of earlier unseasonable weather and therefore to mean little more than a delayed development, and temperatures rarely drop the last of June to such an extent as to do more than somewhat retard biological processes. Generally speaking, the critical period is limited to the ten days from June 11th to 20th, inclusive. It will be seen by referring to the tables given above, that the maximum, minimum and effective temperatures for mid-June in both 1912 and 1914 are markedly lower than the average for the decade tabulated, with the possible exception of the year 1907, and here we have, especially in minimum temperatures, an approximation to conditions obtaining in the two years mentioned above, though it should be noted that the effective temperatures for the ten days under consideration exceed the average for the decade, conditions by no means obtaining for the same period in 1912 and 1914. It should also be noted in connection with the 1907 records, that the temperatures for the first period are considerably lower than the normal, and consequently it is evident that the season was an exceptionally late one, the low temperatures of the first part of June simply checking development without any special hazard to insect life.

There is a question as to what point should be taken as the biological zero in endeavoring to ascertain the effect of temperature upon animal life, and in this instance we have based our calculation upon two points and present below a comparison of data thus secured.

Comparison of deficiency in temperature units for June 11th to 20th

0 =	1912 43°	1912 55°	1914 43°	1914 55°
Maximum temperatures	41.6	41.6	31.6	31.6
Minimum temperatures	30.5	31.8	32.5	36.8
Effective temperatures	41.2	75.5	33.2	70.5

It will be seen by referring to the table, that so far as maximum and minimum temperatures are concerned the units are nearly identical, whether we start at 43° or 55°. This is far from the case, however, when we come to the effective temperatures, there being a much greater discrepancy when zero equals 55° than if we start

with 43°. The available data, so far as the elm leaf beetle and local conditions are concerned, justify the following tentative conclusions:

The inhibitory action of low temperatures is about equally evident in both maximum and minimum temperatures when 43° or 55° are taken as zero. The contrast is much more apparent in effective temperatures when calculations are based on 55°, and then the difference from the average approximates the sum of similarly obtained maximum and minimum units.

A reduction below the average of 30 to 40 units in either maximum or minimum temperatures or of 70 units in effective temperatures (if 55° is taken as 0) during a ten-day period when egg laying by the elm leaf beetle is normally at its height, checks oviposition and is very likely to be followed by an unusual mortality in both eggs and young grubs.

The relation existing between the development of the insect and the effect unusually low temperatures may have, should be always kept in mind, since if this is done we may be able to explain in part why the elm leaf beetle may be abundant and injurious in some sections and almost innocuous in others the same season, due to the fact that a widespread, cool wave would not have a uniform effect upon the insect, owing to its development being materially affected by local influences. Studies of other workers have shown that under normal conditions the rate of average variation for the beginning or ending of any biological phenomenon is not far from one day for every fourth of a degree of latitude or for every 100 feet of elevation. With this as a basis and the preceding regarding temperature in mind, it may be readily seen that a cool period might be very injurious to the elm leaf beetle at Nassau and comparatively harmless in the lower Hudson valley or on Long Island.

These facts in relation to temperature have a practical bearing, in that they give an approximate basis, at least, for determining the probability of serious injury locally before the brood has developed to such an extent as to damage the trees materially. It is easy to approximate the number of beetles which have overwintered by the amount of feeding upon the unfolding leaves, and now it seems possible to go further and determine in advance, with some degree of assurance, whether eggs and young grubs will thrive and develop normally, provided we have reasonably detailed information in respect to temperature conditions.

The calculation of temperature units is not a congenial occupation for the average man and we are therefore giving below the maximum and minimum temperature records for Chatham, N. Y., for 1910 to

1914 inclusive, so that comparison may be made between the two years 1912 and 1914 when unusually low temperatures checked the normal breeding of the elm leaf beetle, and those of 1910, 1911 and 1913, years when the insect was rather destructive and therefore presumably not checked by weather influences. The important period, as noted above, comprises June 11th to 20th, and the temperatures of 1912 should be compared with those for corresponding dates above or below and those for 1914 with the three normal years. It will be observed at once that the minimum temperature dropped considerably lower and more frequently during these two years, falling in 1912 to 38 on the 14th and to 46 or 45 on the 13th, 15th and 19th. There is a fall, though proportionately less, in the maximum temperatures. Somewhat the same conditions obtained during this ten-day period in 1914, except that the cool weather came from the 16th to the 20th, there being a period of six successive days, if we count the 21st, when the minimum ranged from 52 to 39. There was also a perceptibly lower maximum.

Adding the maximum and minimum temperatures and both combined, also given in our temperature tabulation, we likewise find during this ten-day period, a markedly lower average than for the same periods in the other years. This is so evident that we would suggest the following as a tentative rule: when the sum of the maximum and minimum temperatures (F.) for a ten-day period for or about the middle of June does not exceed 1250 units, the probabilities are that egg laying will be checked and that an unusual mortality will occur in both eggs and young grubs.

Maximum and minimum temperatures for Chatham, N. Y., June 1910–14 inclusive

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Mean
1910	Max..	56	60	70	61	63	70	68	68	72	63	59	63	78	82	86	80	78	77	82	84	89	89	84	78	77	82	77	81	81	84	74.7
	Min..	45	46	46	38	37	49	49	48	44	50	52	53	50	54	59	61	60	59	60	56	61	59	62	55	51	57	61	63	52	55	53.1
1911	Max..	66	81	73	79	75	60	66	75	81	84	86	80	70	70	74	65	75	79	84	80	70	75	78	76	73	73	82	86	79	79	75.8
	Min..	56	44	51	48	52	48	56	56	50	56	55	60	57	59	57	49	45	49	53	59	49	49	56	48	53	57	67	69	53	50	53.7
1912	Max..	82	88	80	82	66	64	62	66	66	76	80	77	70	70	67	68	83	73	73	78	77	79	82	87	84	86	80	85	89	80	76.7
	Min..	44	54	64	57	51	51	49	35	41	44	49	50	46	38	46	55	62	51	45	58	64	54	50	52	62	66	49	56	65	48	51.9
1913	Max..	81	78	78	75	74	78	81	65	61	70	79	80	83	84	83	91	86	76	72	70	80	78	82	87	85	77	87	83	83	93	79.3
	Min..	47	57	44	57	47	52	64	43	34	35	41	46	50	59	48	65	65	44	48	57	65	57	51	56	62	60	68	63	49	53	52.9
1914	Max..	78	72	74	67	67	74	86	83	75	89	85	89	68	73	74	66	73	80	74	67	75	76	80	92	88	88	78	69	71	67	76.5
	Min..	55	46	44	55	47	58	62	61	56	56	53	56	53	51	54	50	39	48	52	40	42	57	55	65	65	54	58	59	56	55	53.4

Totals of Fahrenheit readings for ten-day periods, Chatham

	JUNE	MAXIMUM	MINIMUM	MAXIMUM AND MINIMUM
1910	1–10	651	462	1113
	11–20	769	564	1333
	21–30	822	576	1398
1911	1–10	740	517	1257
	11–20	763	543	1306
	21–30	771	551	1322
1012	1–10	732	490	1222
	11–20	739	500	1239
	21–30	829	566	1395
1913	1–10	741	480	1221
	11–20	804	523	1327
	21–30	835	584	1419
1914	1–10	765	540	1305
	11–20	749	496	1245
	21–30	784	566	1350

Gipsy moth (Porthetria dispar Linn.). Last May a fair-sized gipsy moth colony was discovered at Mount Kisco, Westchester county. The infestation was evidently of two or three years' standing. One oak was rather badly infested and the insects had spread from it to nearby smaller trees and shrubs on a stony hillside. There were several egg masses on trees some distance from the center of infestation. An agent of the State Department of Agriculture accompanied the Entomologist at the time of the initial examination, and although a few of the insects had commenced to hatch and it was therefore a little late to secure the best results, the outcome of the season's work leaves little to be desired. Efforts were concentrated upon creosoting egg masses, repeated and heavy sprayings with poison and banding with tree tanglefoot and burlap. Three weeks after the infestation was discovered only three or four small caterpillars were found alive in the center of the colony. Very few living larvae were seen later and on October 22d some hours' exploration resulted in finding no living egg masses.

Several seasons must elapse before it will be possible to say that extermination has been the outcome of the vigorous measures of last summer. Winter scouting may result in finding a few egg masses. There can be little difference of opinion as to the wisdom of adopting extreme measures in such an isolated infestation. The

nearest colonies known are on the border of Lenox and Stockbridge, Mass., and at Great Barrington. The first named is practically exterminated and the other on the verge of extinction. It is extremely important that these infestations be detected early and the insects destroyed if possible, otherwise the State of New York will soon have a serious gipsy moth problem comparable to that of the New England States.

Norway maple leaf hopper (Alebra albostriella Fall.). The Norway maple is comparatively free from injurious insects and the reported severe injury to foliage by a leaf hopper was therefore unexpected. Mr F. A. Bartlett of the Frost & Bartlett Company, states that Norway maples in the vicinity of Stamford, Conn., are frequently seriously injured by this species, many leaves dropping in midsummer. Similar conditions were found to obtain in New Jersey in the vicinity of Morristown and also at certain Long Island localities. Under date of July 23, 1914, Mr Clinton C. Lawrence forwarded from Newburgh, N. Y., an excellent series of this species, together with leaves which showed severe and characteristic leaf hopper injury.

This small leaf hopper is only about one-eighth of an inch long and so far as specimens in the State collections are concerned, is mostly yellowish or yellowish orange. It is about the same size as the whiter and much better known rose leaf hopper and presumably has somewhat the same habits, though records concerning its life history and food plants are lamentably scarce. This leaf hopper is evidently quite variable, as it has been described under no less than seven different names in Europe and four in this country. It has been recorded in America from Canada south to Washington and west to Illinois and Michigan. Mr E. P. Van Duzee captured specimens at Hamburg, N. Y., " sweeping ferns and rank weeds," and it has been reported as occurring on pear and cherry. Melichar, in his work on the Cicadas of middle Europe, states that this species is quite abundant on oak. State Museum material indicates the occurrence of adults during July and August at Jamaica, Newburgh, Kingston, Phoenicia and Ausable Lake. These data, taken in connection with what is known of the insect, indicate a wide and general distribution.

This species was first recorded in America in 1864. It probably subsists for the most part upon comparatively valueless plants, though the above-mentioned injury indicates a probable change in food habits and the possibility of it becoming of considerable economic importance. Mr Bartlett states that last year he was able to con-

trol the leaf hopper almost entirely by spraying with black leaf 40 early in the spring, and that the results obtained have not been so satisfactory this season, although the work was very thoroughly done. There is obvious need of further information concerning the habits of this insect. An excellent bibliography is given by Prof. C. P. Gillette in the Proceedings of the United States National Museum, 1898, 20:713.

Pine leaf scale (*Chionaspis pinifoliae* Fitch). The nearly snow-white scales of this pest contrast strongly with the rich green of the pine needles, making the insect very conspicuous. It is a form (plate 2, figure 5) reported almost every year and occasionally twigs are received showing a very severe infestation, which was the case with material transmitted for identification from Flushing and Plattsburg. The specimens of the former lot proved to be abundantly infested by small four-winged parasites; hundreds of *Aspidiotiphagus citrinus* Craw. and smaller numbers of *Aphelinus mytilaspidis* LeB. were obtained and subsequently kindly determined by Dr L. O. Howard of the Federal Bureau of Entomology. A third parasite, *Perrissopterus pulchellus* How., has also been reared from this pine scale. Occasionally this pest multiplies excessively and seriously weakens trees or groups of trees. This was particularly noticeable a few years ago in the case of some Austrian pines growing in Washington Park, Albany.

The reddish young of this scale hatch about the middle of May in the latitude of Albany, most of the insects establishing themselves upon the tender needles at the ends of the twigs. The hatching period is protracted and, as a consequence, there is more or less overlapping of the two and possibly three generations annually, according to the observations of Prof. R. A. Cooley at Amherst, Mass.

The crawling young of this insect can be destroyed by spraying with a contact insecticide such as black leaf 40, used at the rate of three-fourths of a pint to 100 gallons of water, to which is added 5 or 6 pounds of soap. Some practical tree men are using a miscible oil diluted 1 to 16 and making the application before the buds have started. This treatment is said to be very successful and to cause no injury to the trees, provided the work is done before the buds have started and become soft.

Scurfy scale on Norway maple (*Leucaspis japonica* Ckll.). The Norway maple is exceptionally free from insect pests in America and we were therefore surprised to receive from the Frost

& Bartlett Company, Stamford, Conn., twigs and leaves of this tree showing a somewhat severe infestation by the above-named insect. Several trees were infested and at least one was in a weakened condition. The scale has much the shape of that of Lepidosaphes ulmi Linn., except that it is somewhat broader. It is a small species,being only 1.5 to 2 mm long and a dull grayish white (pure white when the scale is first secreted). The twig submitted for examination was thickly infested, while small numbers of the scale insects had established themselves at the base of the principal leaf veins with scattering individuals ranged along the veins to the middle of the leaf. The absence of the tricarinate male scales characteristic of Chionaspis, serves at once to distinguish the common scurfy scale from this much rarer form. The insect was also found on an adjacent privet hedge.

There is very little literature relating to this species. It was described in 1897 by Professor Cockerell from specimens taken on broom shipped from Japan by Mr Alex. Craw the preceding year, and subsequently it was found by Mr Craw on Magnolia souliana and maples, species not indicated, from the same country. There are specimens in the State collection on orange, received from Mr S. I. Kuwana, which, while closely allied, do not appear to be identical with the form taken on Norway maple.

Spruce bud scale (Physokermes piceae Schr.). The smaller twigs of Norway spruce, especially those infested with the spruce gall aphid, Chermes abietis Linn., are occasionally in a weakened, dying condition and, in some instances at least, are rather badly infested by this scale insect. This peculiar pest establishes itself at the base of the branchlets, there sometimes being clusters of two to five or even six of the oval, chestnut-brown scale insects on a twig having a diameter of less than one-eighth of an inch. Each of these very closely resembles a somewhat abnormally developed bud and is easily mistaken for such (plate 3, figure 3). Spruce twigs suffering from the attack of this insect are often received in early July, at which time the young may be found under the mother scales. An observation made some years ago shows that occasionally this scale insect may be extremely abundant, since Prof. Burton M. Gates records that in May and June 1908, bees were attracted in large numbers to spruce trees at Amherst, Mass., by copious exudations of honeydew produced by this bud-resembling scale. The many bees attracted produced a noise suggestive of swarming. The extraction of any such amount of honeydew from a tree must mean a serious reduction in its vitality, and as this scale

insect is frequently associated with dying branchlets, we are inclined to believe that it is an important factor in disfiguring many Norway spruces. Gillanders states that in England healthy spruce trees are not appreciably affected by the presence of this scale insect, though weakly ones are sometimes killed by it and the associated Chermes abietis Linn.

This species has, to our knowledge, become established in Brooklyn, Mount Vernon, Albany and Port Henry, and is probably widely and somewhat generally distributed in the State. The winter is presumably passed by the partly grown young which, according to Gillanders, are rather effectually hidden on the small twigs. Newstead has reared from this insect a Chalcid, Encyrtus scaurus Walk., and it is commonly believed that natural enemies are very effective checks.

The most promising method of controlling this scale insect is by spraying in early spring with a contact insecticide, especially with an oil as for the somewhat closely related Lecaniums.

False maple scale (Phenacoccus acericola King). The report of this office for 1913, page 59, describes a very serious infestation by this insect upon certain hard maples near the New Haven Railroad station at Mount Vernon. These were so badly infested in 1913 that practically every leaf bore six to twenty-five of the conspicuous cottony females, while the portions between were thickly spotted and, in some instances, practically coated with the numerous yellowish young. The trunks were also liberally plastered with the white cocoons of the male.

An examination of this tree in September last, showed it to be in a somewhat weakened condition, there being a few limbs bare of leaves and a few small, dead branches. The infestation was not nearly so severe as that of a year ago, though the trunk of the tree was irregularly spotted with the white cocoons and a large proportion of the leaves bore cottony females, there being three to five on almost every leaf. The observation shows that while this insect may become exceedingly abundant in the fall, such an outbreak is not necessarily very injurious to the trees.

Mulberry white fly (Tetraleyrodes mori Quaint.). Leaves of the Mountain Laurel, Kalmia latifolia, were received in July from Mount Kisco through the State Department of Agriculture and found to be rather thickly infested with this white fly. The oval, black insects about one-thirty-fifth of an inch long and margined with a white, waxy secretion which approximately doubled their size, presented a striking appearance.

This species was originally described from Florida and at that time recorded on the leaves of mulberry, linden, Tilia americana, French mulberry, Calicarpa americana, sweet gum, Liquidamber styraciflua, American holly, Ilex opaca and less frequently on Red Bay, Persea borbonia. In addition, Doctor Britton[1] has recorded the occurrence of the variety, maculata Morr., in Massachusetts and Connecticut on ash, hornbeam, Catalpa and hickory, and states that this species should also occur in New Jersey.

FOREST TREE PESTS

Spruce bud moth (Tortrix fumiferana Clem.). The abundant flights of this small, brownish moth have attracted attention here and there for several years, being indications of the insect breeding in large numbers. There has been considerable injury to spruces in certain Adirondack localities, though the damage does not seem to approach that recorded from sections in Maine.

The past season was marked by complaints of the work of the caterpillar upon ornamental spruces from Tarrytown, Albany and Schenectady. In one instance, at least, the blue spruce was attacked. The reports were received early in June at the time the small, brownish caterpillars, about three-fourths of an inch long and rather easily recognized by the slightly flattened body and the series of large, yellowish white tubercles or warts, were full grown. Early spraying with arsenate of lead, using 3 pounds to 50 gallons of water, is the most promising method of checking this insect whenever its abundance necessitates remedial measures.

Ugly nest cherry worm (Archips cerasivorana Fitch). The silken webs of the yellow, black-headed caterpillars of this chokecherry leaf feeder were unusually abundant the latter part of June in southern Rensselaer and northern Columbia counties. In some cases extended patches along the roadside were covered with the webs of this caterpillar. The full-grown larvae are lemon-yellow, clothed with scanty, fine, yellowish hairs, the head, the prothoracic shield, the anal shield and the true legs being black, while the mouth parts are brown. Transformations occur within the webs, the pupae wriggling partly out of the nest before the disclosure of the variable yellow and leaden-blue moths. This leaf-feeder confines itself to chokecherry and is therefore of no economic importance though its conspicuous nests frequently arouse apprehension.

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[1] Insects of New Jersey, p. 120, 1909.

Maple and oak twig pruner (Elaphidion villosum Fabr.). Small, clean-cut twigs of oak, maple or other trees falling during the summer or hanging in a wilting or dry condition, are the most striking signs of this insect's work. Numerous reports were received the past season concerning injuries by this insect, especially from the vicinity of New York City. Incidental observations along the Hudson valley showed that this borer was unusually abundant. It confines its operations largely to the smaller twigs, rarely cutting branches with a diameter more than three-fourths of an inch. Limbs injured by this borer have the central portion traversed to a greater or less extent by a somewhat irregular gallery inhabited (plate 3, figure 1) by a legless grub about three-fourths of an inch long. The parent insect is a grayish brown beetle with a length of about five-eighths of an inch. The habit of cutting off the limbs, leaving only a small portion of the bark or outer sapwood, affords an excellent means of identifying the depredator and distinguishes its operations at once from the wilting of twigs resulting from the oviposition scars of the periodical Cicada, Tibicen septemdecim, or the death of small twigs as a result of fungous infection.

Normally the grubs fall with the severed leaves and remain in their retreats over winter, consequently the systematic collecting and burning of the fallen branches is the most economical method of checking this borer. Ordinarily it does not cause serious injury, though the brown, dead tips produce a very unsightly appearance.

Periodical cicada (Tibicen septemdecim Linn.). Injuries by this insect are limited almost entirely to the damage caused by oviposition, especially in young trees, since the latter are much more liable to be severely affected. An interesting case came under observation last summer; the trees belonged to Mr Hubert Gage of Rhinebeck, and the initial injury was caused in 1911. Many of those badly affected were much stunted, and the most seriously damaged twigs had made little or no growth.

In a few cases there was during the past three years, less than ten inches of growth, and in one or two instances the comparatively vigorous development of last year had withered and died during late summer, probably as a result of a deficient supply of sap, owing to the interference of circulation by the abnormal tissues below.

The obvious conclusion is that in the case of badly injured young trees it is highly desirable to eliminate as much of the injured wood as possible, even though severe cutting must be done for two or three years, because it was evident from the condition of some of these trees that limbs showing numerous scars would amount to very

little so far as crop production was concerned. This is particularly true in cases where there is a series of two or three nearly contiguous scars, since the chances are that such limbs will break off with the first heavy load of fruit, if not earlier.

MISCELLANEOUS

Orchid pests. The orchid Isosoma, I. orchidearum Westw., is a European insect which was first discovered in this country in 1889 at Natick, Mass., undoubtedly being introduced with imported plants, since Riley in 1880 records the pest as quite common in some Paris conservatories. The species has apparently not attracted notice subsequently until infested bulbs were received last July from Mount Kisco, accompanied by the statement that they had been taken in a local conservatory. Several species of Cattleya, notably C. trianae, C. eldorado and C. gigas, are liable to infestation. During the resting season of these plants the pseudo-bulbs may suddenly start into activity, increase rapidly in size and assume a spherical shape, according to Prof. A. P. Morse of Wellesley. Within these pseudo-bulbs there is an irregular cavity containing three to eight white maggots. The insects complete their transformations within the cavity and emerge as small, greenish, four-winged gall wasps.

Infested bulbs fail to produce flowers and the consequent abnormal growth, if the insects are numerous, reduces the vitality of the plants to such an extent that they gradually wither and die in two to three years.

The Cattleya midge, Parallelodiplosis cattleyae Moll., lives as a yellowish maggot near the tips of the roots of these orchids, producing unsightly galls, in which one to seven maggots occur, each in a cavity by itself. This insect is quite different from the preceding and is one of a very large number of gall midges which live at the expense of many different kinds of plants.

The most satisfactory method of controlling both of these insects is to keep a close watch of the plants and promptly destroy by burning any infested parts before the larvae can mature and the parent flies deposit eggs upon other orchids. Fumigation has also been advised for the destruction of the adults, though the probablities are that this would be comparatively inefficient, owing to the difficulty of timing the treatment so as to catch numbers of the flies before they have had an opportunity to deposit eggs. It is by all means desirable to adopt reasonable precautions for preventing the introduction of infested plants, and measures of this character will produce much more satisfactory results than is possible by remedial treatment.

Cotton moth (Alabama argillacea Hübn.). The appearance of this southern moth in New York State is interesting, though by no means unprecedented, since it was recorded in 1911 from three New York counties and in 1912 from sixteen, the specimens being taken mostly in September and October.

September 25th C. C. Laney, superintendent of Rochester parks, transmitted a number of specimens with the statement that they had been flying around the city in great numbers for several days. Mr M. S. Baxter of the same city also forwarded specimens which he stated had literally swarmed for two days around the electric lights. On October 20th, he forwarded additional moths with the statement that they had appeared in such numbers that it hardly seemed possible they had remained about the city since the great flight of September 25th. A number of the moths, some perfect, unrubbed specimens were observed Monday morning, October 19th, here and there under electric lights on State street, Albany. It was easy to find three to ten or even fifteen specimens about a light. A similar though smaller flight of these insects was also observed on the morning of the 21st. At the latter date there were equal, if not larger, numbers of the lime tree winter moth, Erannis tiliaria Harr. English sparrows were observed feeding eagerly upon the adults of both species.

Phlyctaenia terrealis *Treits.* Small, greenish caterpillars webbing together the tips of the Marsh Shield fern, Dryopteris thelypteris, were received June 19, 1914 from S. H. Burnham of Hudson Falls. The terminal leaves were drawn together in an irregular, webbed retreat some 2 cm in diameter, the interior being hollow and partly filled with frass. Meyrick records this species as living on Solidago virgaurea and gives its distribution as central Europe, western central Asia and North America. Detailed descriptions of the larva and pupa follow.

Larva. Length 2 cm. Head a variable yellowish orange, with irregular, lighter anastomosing striations. Ocelli five in number, whitish transparent, arranged in a semicircle variably margined with dark brown. Labrum yellowish, mandibles yellowish basally, changing to reddish brown, the teeth dark brown. Antennae triarticulate, the basal segment stout, with a length one-fourth greater than its diameter, whitish transparent, brown-margined, the second segment slender, with a length three times its diameter, light brown, the third segment as long as the second, more slender, tapering apically. Body a somewhat variable light green, being darker along the dorsal vessel, the tubercles whitish and fuscous margined. Thoracic shield a variable yellowish brown, there being irregular,

darker brown markings laterally and at the latero-posterior angles; laterally an irregular, fuscous brown sclerite extends from below the spiracle to the anterior margin of the segment. Second and third thoracic segments, each with two pair of submedian, irregularly oval bisetose tubercles, the pair on the second segment approximate; laterally near the stigmatal line there are two tubercles, the anterior irregular, bisetose, the posterior nearly circular, unisetose; at the base of each true leg a large, irregularly angular, unisetose tubercle. Abdominal segments with two pair of submedian tubercles, the anterior broadly oval, the posterior narrowly oval and more distant, both unisetose; laterally just above the spiracle an angulate, unisetose tubercle and a little below the spiracle an oval, bi- or trisetose tubercle; the 13th segment with a large median, ovoid, polysetose tubercle, the suranal plate with about 8 long, stout, reddish setae; true legs yellowish with variable, darker brown markings; prolegs whitish transparent, the circle of claws reddish brown.

Pupa. Length 3 mm, mostly a slaty reddish brown, the lateral anterior angles of the mesonotum marked by an oval elevation, the central portion of which is yellowish brown; the first to fourth abdominal segments narrowly margined dorsally next the wing pads with fuscous yellowish, the incisures yellowish, cremaster consisting of about 8 slender, yellowish red spines. Leg, antennal and ventral third of wing cases an obscure yellowish, the spiracles reddish orange.

Red spider (*Tetranychus telarius* Linn.). Red spiders, according to reports received from Mr W. H. Hart of Arlington, became so abundant the latter part of July in a young apple orchard, that it was deemed advisable to spray for the purpose of controlling the pest. A thorough application of a lime-sulphur wash diluted 1 to 45 and containing 2 pounds of arsenate of lead to 50 gallons of water, was made and about two weeks later Mr Hart reported the treatment as being extremely efficacious, the sprayed trees being almost wholly free from the red spider, while the unsprayed trees were badly infested and showed perceptibly browner foliage. The sulphur wash was undoubtedly the efficient agent in this treatment.

LIST OF THE COCCIDAE IN THE COLLECTION OF THE NEW YORK STATE MUSEUM

BY F. T. HARTMAN

There are in the New York State Museum at the present time, 173 species of scale insects, of which 68 are found in New York, 41 have been received in exchange from Japan and the others are from widely separated places in the United States. The greater part of these have been received in recent years, but a few date back to the time of Doctor Fitch. Among these are three microscopic mounts of Aspidiotus furfurus Fitch, now Chionaspis furfura. Two bear the label: "Female from under a scale, labeled by Dr Asa Fitch as Aspidiotus furfurus, mounted by J. Henry Comstock, 28 December 1880." The third is labeled: "Female from under a scale, labeled by Dr Asa Fitch as Aspidiotus cerasi. It is specifically the same as Asp. furfurus Fitch, J. Henry Comstock, 28 December 1880." There is always a certain amount of material coming in which proves, on microscopic identification, to be one or another of several common and well-distributed forms. Such common species as Gossyparia spuria, Pulvinaria acericola, P. vitis, Lecanium corni, L. prunastri, the plum scale, Chionaspis furfura, the scurfy scale, C. pinifoliae, Aulacaspis rosae, Aspidiotus ostreaeformis, the San José scale and Lepidosaphes ulmi are, like the poor, "always with us." Nine types and seven cotypes are represented and those with microscopic mounts are indicated by the asterisk.

COCCIDAE

Subfamily Monophlebinae

Drosicha lichenoides Ckll.
On Ficus nota
From Los Banos, P. I.
Received from C. F. Baker, through T. D. A. Cockerell, Boulder, Col.

Icerya purchasi Mask., cottony cushion scale
On Scotch broom and Acacia
From Albany, N. Y.
Received through L. Menand; also from Leland Stanford University, Cal., S. I. Kuwana, through V. L. Kellogg

I. seychellarum West.
From Okitsu, Japan
Received from S. I. Kuwana, Tokio, Japan

I. zeteki Ckll., type
From Panama Canal Zone
Received from James Zetek, through T. D. A. Cockerell, Boulder, Col.

Subfamily Dactylopiinae

Asterolecanium pustulans Ckll.
From Chatham, N. Y.
Through State Department of Agriculture

A. variolosum Ratz., golden oak scale
On golden oak
From Flushing, Cortland, Geneva, Newburgh, Woodlawn Cemetery, N. Y.
Received from Mrs George W. Rains and also from S. I. Kuwana, Leland Stanford University, Cal., through V. L. Kellogg

Lecaniodiaspis quercus Ckll.
On Quercus species
From Tokio, Japan
Received from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

Cerococcus ehrhorni Ckll.
On live oak
From California
Received from E. M. Ehrhorn, through V. L. Kellogg, Leland Stanford University, Cal.

C. quercus Comst.
On oak
From California
Collected by E. M. Ehrhorn

Kermes cockerelli Ehrh.
On Quercus kelloggi
From California
Received from George B. King, Lawrence, Mass.

K. essigii King
On Quercus agrifolia
From California
Received from George B. King, Lawrence, Mass.

K. galliformis Riley
From Karner and Middletown, N. Y.
Received from George B. King, Lawrence, Mass.

K. kingii Ckll.
On oak
From Albany, N. Y.

K. nivalis King & Ckll.
On Quercus rubra
From Lawrence, Mass.
Received from George B. King.

K. pubescens Bogue
On white oak
From Lawrence, Mass.
Received from George B. King

K. vastis Kuw.
On Quercus
From Niigata, Japan
Received from S. I. Kuwana, Tokio, Japan

Gossyparia spuria Mod., European elm scale
On various species of elm; widely distributed throughout the State
Also from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

Eriococcus adenostomae Ehrh.
On Adenostoma fasciculatus
From California
Received from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

E. araucariae Mask.
On Araucaria excelsior
From California
Received from G. A. Coleman, through V. L. Kellogg, Leland Stanford University, Cal.

E. artemisiae Kuw.
On Artemisia californica
From California
Received from V. L. Kellogg, Leland Stanford University, Cal.

E. azaliae Comst.
On azalia
From Brooklyn, N. Y.

E. borealis Ckll.
On Betula
From Boulder, Col.
Received from T. D. A. Cockerell

E. graminis Mask.
On bamboo
From Gifu-keu, Japan
Received from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

E. lagerstroemia Kuw.
On Lagerstroemia indica
From Nishigahara, Tokio, Japan
Received from collector Fukaya, through S. I. Kuwana, Tokio, Japan

Dactylopius coccus Costa, cochineal insect
On cypress
From California
Received from G. A. Coleman, through V. L. Kellogg, Leland Stanford University, Cal.

D. confusus Ckll.
On Cupressus macnabiana
From California
Received from G. A. Coleman, through V. L. Kellogg, Leland Stanford University, Cal.

Phoenicococcus marlatti Ckll.*
On date palm
From Arizona
Received from T. D. A. Cockerell, Boulder, Col.

Halimococcus lampas Ckll., type
On palm
From Natal
Received from Claude Fuller, through T. D. A. Cockerell, New Mexico

Phenacoccus acericola King*
On hard maples; abundant in the Hudson valley

P. pergandei Ckll.
On Kaki
From Shigoken, Japan
Received from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

Trionymus violascens Ckll., type
On Agropyron
From Colorado
Received from T. D. A. Cockerell, Boulder, Col.

Pseudococcus adonidum Linn., long-tailed mealy bug*
Grown indoors
From Winfield, N. Y.
Received from C. E. Olsen

P. citri Risso, short-tailed mealy bug
On Ipomoea learii
From Florida

P. ledi Ckll., cotype*
On Ledum groenlandicum
From Sand Lake, N. Y.
Received from C. H. Peck

P. pseudonipae Ckll.
On palm in nursery
From California
Received from E. M. Ehrhorn, through V. L. Kellogg, Leland Stanford University, Cal.

Cryptococcus fagi Baer.
On beech
From Canada
Received from R. W. Braucher, Kent, O.

Antonina crawi Ckll.
From Tokio, Japan
Received from S. I. Kuwana

Subfamily Tachardiinae

Tachardia glomerella Ckll., type
On Gutierrezia
From New Mexico
Received from T. D. A. Cockerell, Boulder, Col.

Subfamily Coccinae

Takahashia japonica Ckll.
From Yamagata, Japan
Received from S. I. Kuwana, Tokio, Japan

Pulvinaria acericola Walsh, cottony maple leaf scale
Common through the State

P. aurantii Ckll.
On Thea sinensis
From Tokio, Japan
Received from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

P. citricola Kuw.
On Citrus tree
From Tokio, Japan
Received from S. I. Kuwana

P. hazae Kuw.
From Tokio, Japan
Received from collector Murata, through S. I. Kuwana

P. horii Kuw.
On maple
From Tokio, Japan
Received from collector Fukaya, through S. I. Kuwana

P. idesiae Kuw.
On Idesia polycarpi
From Tokio, Japan
Received from collector Fukaya, through S. I. Kuwana

P. occidentalis subalpina Ckll., part of type
From T. D. A. Cockerell, Boulder, Col.

P. oyamae Kuw.
On Populus
From Niigata, Japan
Received from collector Yoshino, through S. I. Kuwana, Tokio, Japan

P. photiniae Kuw.
On Photinia villosa
From Tokio, Japan
Received from S. I. Kuwana

P. rhois Ehrh.
On Rhois diversiloba
From California
Received from E. M. Ehrhorn

P. vitis Linn., cottony maple scale
Common through the State

Protopulvinaria longivalvata bakeri Ckll., cotype
From Los Banos, P. I.
From C. F. Baker, through T. D. A. Cockerell, Boulder, Col.

Pseudophilippia quaintancii Ckll.
On pitch pine
From Orange, N. Y., and Pike, Pa.
Received from H. A. Fredenberg, Port Jervis, N. Y.

Eriopeltis coloradensis Ckll., type
From Boulder, Col.
Received from T. D. A. Cockerell

E. lichtensteinii Sign.
On grass
From Stark, N. Y.
Received from C. O. Houghton

Ericerus pela Chav.
On Ligustrum itola
From Tokio, Japan
Received from S. I. Kuwana

Ceroplastes brunneri Ckll., part of type
From San Bernardino, Paraguay

C. ceriferus And.
On tea
From Kiushiu, Japan
Received from S. I. Kuwana, Tokio, Japan

C. cirripediformis Comst., Barnacle wax scale
On China tree
From Louisiana

C. floridensis Comst., Florida wax scale
On leaves of Persea carolinensis
From Florida

C. sanguineus Ckll.
From Paraguay
Received from T. D. A. Cockerell, Boulder, Col.

Eucalymnatus tessellatus Sign., tessellated scale
On fern
From California
Received from S. I. Kuwana, Tokio, Japan

Coccus diversipes Ckll., part of type
On fern
From Lucena, P. I.
Received from collector Townsend

C. hesperidum Linn., soft brown scale*
On English laurel and begonia
From Ogdensburg, Chatham Center, Irvington, N. Y.
Received from C. J. Locke and State Department of Agriculture

C. salicis Fitch
On Willow
Received from New York State Agricultural Society

Neolecanium sallei Sign.
From Guatemala
Received from Dr William M. Wheeler

Toumeyella liriodendri Gmel., tulip soft scale
On tulip tree and Magnolia; common in southern part of the State and in parks

T. turgidum Ckll.
On stems of Magnolia glauca
From Florida

Eulecanium glandi Kuw.
From Tokio, Japan
Received from S. I. Kuwana

E. pyri Schr.
From Scriba, N. Y.
Received from Dr A. C. Taylor

Saissetia hemispherica Targ. Hemispherical scale
On Ardesia crenulata and mistletoe: common in greenhouses

S. nigra Nietn., black scale*
On Gossypium
From St Vincent, W. I.
Received from W. H. Patterson

S. oleae Bern., olive scale
On laurel and lemon
From Maspeth, N. Y.; also from E. M. Ehrhorn, California

Physokermes insignicola Craw.
On Pinus radiata
From California
Received from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

P. piceae Schr.
From Mount Vernon, N. Y.

Acerda californica Ehrh.
On bunch grass
From California
Received from E. M. Ehrhorn

A. tokionis Ckll.
On bamboo
From Tokio, Japan
Received from S. I. Kuwana, and also from California through V. L. Kellogg, Leland Stanford University, Cal.

Lecanium caryae Fitch, hickory Lecanium
Collection of the New York Agricultural Society

L. corni Bouché
On a great variety of plants; common over the State

A specimen in the collections of the New York State Museum labeled by the late Doctor Fitch as Coccus salicis was submitted to Prof. J. G. Sanders for determination. He has identified it as L. corni and writes: "Coccus salicis is L. corni in part, as is shown by the specimen. However, the material labeled Coccus salicis in the original collection now at Washington included also specimens of Pulvinaria vitis. It appeared that Doctor Fitch did not distinguish between Lecanium and Pulvinaria, as several of his original notes refer to the curious fact that some Lecaniums produce a cottony ovisac while others do not."

L. fletcheri Ckll.
On Juniperus virginiana
From Ithaca, N. Y. and also Columbus, O.
Received from J. G. Sanders

L. juglandis Bouché, New York plum scale*
On plum
From Kinderhook, Rochester, Menands and Western New York

L. kunoensis Kuw.
On Rosa rugosa
From Hokkaido, Japan
Received from S. I. Kuwana, Tokio, Japan

L. persicae Fabr., European peach scale
On rambler rose and Magnolia
From Warsaw, Port Ewen, Ravena and Idlewild, N. Y.

L. nigrofasciatum Perg., terrapin scale
On soft maples
Common through the State

L. nishigaharae Kuw.
On Morus alba
From Tokio, Japan

L. pruinosum Coq., frosted scale
On grape and trumpet vine
From Leon and Brighton
Received from C. E. Eldredge

L. prunastri Fonsc., plum Lecanium
On cherry, Ardesia crenulata and plums; common through the State

L. quercifex Fitch
On chestnut and ironwood
From Leon, New Russia, Bolton Landing, Lake George, N. Y.
Received from New York State Agricultural Society, C. E. Eldredge and Miss E. S. Blunt

L. rugosa Sign.
From Kingston, R. I.

Subfamily Diaspinae

Chionaspis americana Johns., elm white scale
On elm, Japanese quince, etc.
From Albany, Newark, Schenectady, N. Y.
Received from J. J. Barden, State Department of Agriculture and W. B. Landreth

C. bambusae Ckll.
On bamboo
From Tokio, Japan
Received from S. I. Kuwana

C. citri Comst., orange Chionaspis
On Citrus
From Nagasaki, Japan
Received from S. I. Kuwana, Tokio, Japan

C. corni Cooley
On Cornus sanguinea
From Geneva, N. Y.
Received from B. D. Van Buren

C. euonymi Comst., Euonymous scale*
On Prunus pissardi and Euonymous
From Nyack, Hudson Heights, Irvington, Great Neck, Roslyn, Fishkill, N. Y.
Received from Mrs E. H. Maire and E. C. Powell

C. furfura Fitch, scurfy scale
On various fruit trees; common through the State

C. gleditsiae Sand., cotype*
On Gleditsia triacanthos
From Columbus, O.
Received from J. G. Sanders

C. hikosani Kuw.
On bamboo
From Tokio, Japan
Received from S. I. Kuwana

C. kiushiuensis Kuw.
On Quercus sp.
From Buzen, Japan
Received from S. I. Kuwana, Tokio, Japan

C. lintneri Comst.*
On Cornus
From Buffalo, Albany, Rochester and Nassau, N. Y.

C. longiloba Cooley
On Populus deltoides
From Painesville, O.
Received from O. H. Swezey, through J. G. Sanders

C. ortholobis Comst., cottonwood scale
On dogwood
From California
Received from V. L. Kellogg, Leland Stanford University, Cal.

C. pinifoliae Fitch, pine leaf scale*
On pines
From Keene Valley, Plattsburg, Karner, Flushing, N. Y. and also from V. L. Kellogg, Leland Stanford University, Cal.

C. quercus Comst.*
On Quercus chrysolepis
From California
Received from E. M. Ehrhorn

C. salicis Linn., willow scale*
On poplar
From Albany, N. Y
Received from S. H. Burnham

C. salicis-nigrae Walsh*
On Salix cordata
From Columbus, O.
Received from J. G. Sanders

C. spartinae Comst.
On Spartina
From Orient Point, N. Y.
Received from Roy Latham; also from California, S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

Diaspis boisduvalii Sign.*
On Phoenix canariensis and greenhouse material in greenhouses

D. bromeliae Kern.
On Palm
From California
Received from E. M. Ehrhorn

D. carueli Targ., Juniper scale*
On Irish Juniper, pine, Swedish Juniper
From Rochester, Sing Sing and Kingston, N. Y.
Through State Department of Agriculture

D. echinocacti Bouché, Cactus scale*
On Cereus grandiflora
From New York City
Received from L. H. Joutel

D. zamiae Morg.*
On greenhouse material
From Altamont, Albany, N. Y.

Aulacaspis crawii Ckll.
On Yumi
From Tokio, Japan
Received from S. I. Kuwana

A. pentagona Targ., West Indian peach scale*
On imported material and from the South
From New York City, Kingston, Chatham, N. Y. and Washington, D. C.

A. rosae Bouché, rose scale*
On rose, raspberry, blackberry; common through the State

Phenacaspis mischocarpi Ckll. & Rob., cotype
On Mischocarpus
From Los Banos, P. I.
Received from C. F. Baker, through T. D. A. Cockerell, Boulder, Col.

P. natalensis Ckll., type*
On Mango
From New Mexico
Received from T. D. A. Cockerell, Boulder, Col.

Hemichionaspis aspidistrae Sign.
On Cycas revoluta, greenhouse
From Albany, N. Y.

H. minor ? Mask.
On orange
From Japan
Received from J. R. Anderson, Victoria, B. C.

H. uvariae Ckll. & Rob., cotype
On Uvaria
From Los Banos, P. I.
Received from C. F. Baker, through T. D. A. Cockerell, Boulder, Col.

Poliaspis carissae Ckll., type*
On Carissa
From Natal
Received from Claude Fuller, through T. D. A. Cockerell, Boulder, Col.

P. pini Mask.
On Abies firma
From Tokio, Japan
Received from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

Leucaspis japonica Ckll.*
On Norway maple
From Stamford, Conn.
Also on orange from S. I. Kuwana, Japan

L. kelloggi Coleman*
On Abies concolor
From California
Received from G. A. Coleman, through V. L. Kellogg, Leland Stanford University, Cal.

Fiorinia fioriniae japonica Kuw.*
On Tsugae seboldi
From Long Island
Through Dr G. G. Atwood

Epidiaspis piricola Del Guer*
On imported pear
Through State Department of Agriculture

Aspidiotus abietis Schr.*
On hard pine, hemlock
From Ithaca and Karner, N. Y.

A. aesculi Johns.
On buckeye
From California
Received from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

A. ancylus Putn., Putnam scale*
On fruit and forest trees; widely distributed

A. caldesii Targ.*
On Pinus ponderosa
From California
Received from G. A. Coleman, through V. L. Kellogg, Leland Stanford University, Cal.

A. coniferarum Ckll.*
On Cypress
From California
Received from G. A. Coleman, through V. L. Kellogg, Leland Stanford University, Cal.

A. cryptomeriae Kuw.
From Okayama, Japan
Received from S. I. Kuwana, Tokio, Japan

A. forbesi Johns., cherry scale*
On fruit trees; widely distributed

A. glanduliferus Ckll.*
On Pinus sylvestris
From Columbus, O.
Received from V. L. Kellogg, Leland Stanford University, Cal.

A. hederae Vall., oleander scale*
On a variety of plants in greenhouses; common

A. juglans regiae Comst., walnut scale*
On maple, European mountain ash
From Brighton and Albany, N. Y.

A. lataniae Sign.*
On Areca lutescens, greenhouse
From Albany, N. Y.

A. osborni New. & Ckll.*
On oak
From Mount Vernon, N. Y.

A. ostreaeformis Curt., European fruit scale*
On horsechestnut, pear, plum, apple, peach etc.; widely distributed

A. perniciosus Comst., San José scale*
On fruit and shade trees of many sorts; abundant throughout the State

A. piceus Sand.
On Liriodendron tulipiferae
From Painesville, O.
Received from J. G. Sanders

A. rapax Comst., greedy scale*
On palm seed, orange and lemon, camellia, greenhouses in New York localities and also
From California
Received from E. M. Ehrhorn

A. ulmi Johns.*
On Catalpa, elm
From Buffalo, Le Roy and Albany, N. Y.

A. uvae Comst., grape scale*
On grapevine
From Nashville, Tenn.
Through Country Gentleman

Pseudaonidia duplex Ckll.*
On orange
From Japan
Via Victoria B. C., from J. R. Anderson

P. paeoniae Ckll.*
From Kiushiu, Japan
Received from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

Chrysomphalus aonidum Linn.*
In greenhouses through the State, on fern, Strelitzia regina and also from Tokio, Japan
Received from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

C. aurantii Mask., red scale of California*
From Mozatlan, Mexico
Received from V. L. Kellogg, Leland Stanford University, Cal.

C. dictyospermi Morg.*
On Kentia balmoriana, fan palm etc.; in greenhouses through the State

C. kelloggi Kuw.*
On Chiengogun
From Kiushiu, Japan

Received from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

C. obscurus Comst.*
On Quercus coccinea
From Columbus, O.
Received from J. G. Sanders

C. perseae Comst.
On leaves of Magnolia grandiflora
From Florida

C. rossi Mask.*
From Lucban, P. I., and also from California
Received from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

C. smilacis Comst.*
On Smilax
From Maspeth, N. Y., and New York City
Received from C. E. Olsen

C. tenebricosus Comst., gloomy scale*
On maple
From Texas, Mississippi and Virginia

Xerophilaspis prosopidis Ckll.*
On Prosopis velutina
From Arizona
Received from T. D. A. Cockerell, Las Vegas, N. M.

Odonaspis bambusarum Ckll.
On bamboo
From Tokio, Japan
Received from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

O. schizostachyi Ckll. & Rob., cotype
On Schizostachyum
From Los Banos, P. I.
Received from C. F. Baker, through T. D. A. Cockerell, Boulder, Col.

O. secreta Ckll.*
On bamboo
From Hikosan, Japan
Received from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

Pseudoparlatoria parlatoroides Comst.
On leaves of Persea carolinensis
From Florida

Aonidia lauri Bouché*, Bay tree scale*
Through State Department of Agriculture

Lepidosaphes alba Ckll.
On Manihot aipi
From Florida
Imported from Nassau, N. P.

L. beckii Newm., purple scale*
On orange, lemon etc.
From the South, Maspeth and Albany, N. Y.

L. crawii Ckll.*
On Angio laitania-kew
From S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

L. gloverii Pack., Glovers scale*
On orange
From Kiushiu, Japan
Received from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

L. newsteadi Sulc.*
On Codeasans sp.
From Tokio, Japan
Received from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

L. ulmi Linn., oyster shell scale*
On a great variety of plants; widely distributed throughout the State

L. uniloba Kuw.
From Tokio, Japan
Received from S. I. Kuwana

Ischnaspis longirostris Sign.
From Yokohama, Japan
Received from S. I. Kuwana, Tokio, Japan

Parlatoria mytilaspiformis Green
From Gifu-keu, Japan
Received from S. I. Kuwana, through V. L. Kellogg, Leland Stanford University, Cal.

P. proteus Curt., chaff scale*
On Tangerine, oranges etc.
From the South, New York, Ossining and Maspeth

P. theae Ckll.*
On imported Japanese maple
From Schenectady and Rochester, N. Y.
Received from H. C. Peck and State Department of Agriculture

P. viridis Full.*
On Japanese maples
From Brighton
Through State Department of Agriculture

P. ziziphus Lucas*
On orange
From Satsuma, Japan
Received from S. I. Kuwana, Tokio, Japan

PUBLICATIONS OF THE ENTOMOLOGIST

The following is a list of the principal publications of the Entomologist during the year 1914. The titles [1], time of publication and a summary of the contents of each are given. Volume and page numbers are separated by a colon.

The Gall Midge Fauna of New England. Psyche, 20: 133–47, 1913

The list records 137 New England species and presents comparative data relating to our knowledge of this group in various sections. The following new species are described: Monardia modesta, Asynapta nobilis, A. frosti, Lobodiplosis speciosa, Coquillettomyia bryanti, Hormomyia shawi, H. modesta, H. pudica, Hyperdiplosis bryanti and Itonida reflexa.

A Rhododendron Borer. Economic Entomology Journal, 6: 427, 1913; Tree Talk, v. 1, no. 2, p. 19

Records injury to rhododendrons by Corthylus punctatissimus Zimm.

The Goldenrod and Its Gall Flies. Guide to Nature, 6: 149–51, 1913

A popular, illustrated notice of the gall insects living upon Solidago or goldenrod.

Petroleum Compounds or Miscible Oils Unsafe on Sugar Maples. Tree Talk, v. 1, no. 2, p. 20, 1913

A brief warning notice describing the salient features of this type of injury.

San José Scale. New York Farmer, November 13, 1913, page 3

A brief summary of the work of Prospaltella perniciosi and Aphelinus fuscipennis, with a request for information from localities where this parasite might be abundant.

Adaptation in the Gall Midges. Canadian Entomologist, 45: 371–79, pl. 12, 13, 1913; Entomological Society of Ontario, 44th Report, p. 76–82, 1913, 1914

A general discussion of biological and structural adaptations in the Itonididae.

San José Scale Parasites. Catskill Recorder, November 28, 1913, page 1; New York Farmer, December 18, 1913, page 3

Records abundance of a parasite, mostly Prospaltella perniciosi Tower, in the Hudson valley and requests specimens.

Two New Canadian Gall Midges. Canadian Entomologist, 40: 417–18, December 1913

Cystiphora canadensis reared from a blister leaf gall on Prenanthes is described as new, and midges reared from the gall associated with Cecidomyia helianthi Brodie are referred to the genus Hormomyia and described in detail.

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[1] Titles are usually given as published. In some instances articles appearing in a number of papers have been given different titles by the various editors.

Didactylomyia capitata n. sp. Psyche, 20: 174, 1913

Description of a gall midge from North Adams, Mass.

San José Scale Parasites. Tree Talk, v. 1, no. 3, p. 22, February 1914

Observations on the abundance and efficiency of San José scale parasites.

Acaroletes pseudococci n. sp. Economic Entomology Journal, 7: 148–49, 1914

Description of a midge reared from larvae preying on Pseudococcus citri in Sicily.

Diadiplosis coccidivora n. sp. Entomologist, 47: 86, 1914

Description of a Ceylonese midge reared from a species of Pseudococcus

Spraying for Insect Pests. Massachusetts Fruit Growers Association Report, 20th Annual Meeting, 1914, page 89–101

A general discussion of spraying and spraying materials, with special mention of the following insects: San José scale, codling moth, plant lice, pear psylla, pear thrips, and false tarnished plant bug.

House Fly. Knickerbocker Press, March 29, 1914, page 1, magazine section

General, illustrated account of the house fly and methods of control.

Cecidomyiidae by J. J. Kieffer, Fascicle 152 of Genera Insectorum. Entomological News, 25: 185–88, April 1914

A critical review of this work.

Genera Based Upon Erroneously Determined Species. Smithsonian Institution, Publication 2256, page 157, March 1914

A brief discussion of what should be the genotype in cases of evident misidentification, with special reference to the Itonididae.

Early Fruit Pests. New York Farmer, April 30, 1914, page 2

A brief warning notice concerning apple tent caterpillars, codling moth, pear thrips and pear psylla.

Report of the Committee on Entomology. New York State Fruit Growers Association Proceedings, 13th Annual Meeting, 1914, page 22–25

Brief notes on San José scale parasites, pear psylla, pear thrips, red bug, banded grape bug and codling moth.

Insects of the Hudson Valley. New York State Fruit Growers Association Proceedings, 13th Annual Meeting, 1914, page 163–68

A discussion of the efficiency of San José scale parasites, codling moth work, red bugs and plant lice.

Protect the Elms. Castletonian (New York), May 9, 1914, page 3

Summary account advocating thorough spraying of the trees.

Apple Tree Pests. Northern Budget (Troy), May 17, 1914, page 3

Brief warning notice relating to red bugs.

Fly Control. Health News, Monthly Bulletin, New York State Department of Health, March 1914, page 86–89

Brief, practical summary of the habits of the house fly, with special relation to its control.

June Beetles. New York Farmer, May 28, 1914, page 4

General warning notice with suggestions for preventing injury.

Caterpillar Control. Troy Budget, June 7, 1914, page 6

Warning notice regarding Xylina antennata Walk., with observations on the value of birds as checks upon caterpillar outbreaks.

Cutworm Warning. Troy Times, June 10, 1914

Directions are given for the control of these pests.

Spraying the Elm Trees. Catskill Recorder, June 12, 1914

Warning notice of probable injury by Galerucella luteola Müll.

Fighting Cutworms. New York Farmer, June 18, 1914, page 5

Directions are given for controlling these pests.

Grasshopper Baits. New York Farmer, June 18, 1914, page 5

Several formulas are given for poisoned baits best adapted for grasshopper control.

Aplonyx sarcobati n. sp. Pomona Journal of Entomology and Zoology, 6: 93–94, 1914

An undescribed midge, representing a new genus for America and reared from a leaf gall on Sarcobates vermiculatus, is characterized.

Additions to the Gall Midge Fauna of New England. Psyche, 20: 109–14, 1914

The following new species are described: Monardia lateralis, M. multiarticulata, M. rugosa, Porricondyla novae-angliae, P. papillata, Lasiopteryx crispata, Schizomyia speciosa, Hormomyia proteana and Parallelodiplosis cinctipes.

Descriptions of Gall Midges. New York Entomological Society Journal, 22: 124–34, 1914

The following new species are described: Colpodia americana, C. capitata, C. ovata, C. porrecta, C. sylvestris, Asynapta apicalis, A. mediana, A. umbra, Porricondyla setosa, Janetiella parma, Toxomyia americana, Bremia borealis, B. tristis, B. montana, Thomasia californica, Hormomyia saturni, Itonida uliginosa and the females of Didactylomyia longimana Felt and Karschomyia viburni Felt.

Cool Weather Aids Aphids. Knickerbocker Press, July 5, 1914

The relation of low temperatures to aphid increase is explained and remedial measures indicated.

Grasshoppers. Post-Standard (Syracuse), July 15, 1914; New York Farmer, July 23, page 4

Summary account of the grasshopper outbreak, advising the use of the Kansas mixture.

The Army Worm. Catskill Recorder, July 31, 1914, page 7; New York Farmer, August 6, 1914, page 1

Brief descriptive account of the army worm with directions for its control.

[Fly Control.] American Journal of Public Health, 6: 621–22, 1914

The necessities of a successful fly campaign are briefly outlined.

Hormomyia bulla n. sp. Canadian Entomologist, 46: 286–87, 1914

The gall on Helianthus and both sexes are described.

Conical Grape Gall, Cecidomyia viticola. Economic Entomology Journal, 7: 339, 1914

Observations are given on the larva and the gall, the former being described.

Gall Midges as Forest Insects. Ottawa Naturalist, 28: 76–79, 1914,

A summary discussion of gall midges as forest insects and the description of Rhabdophaga swainei n. sp.

New Gall Midges (Itonididae) Insecutor Inscitiae Menstruus 2: 117–23, 1914

The genus Konisomyia is erected and the following new species described: Tritozyga fenestra, Konisomyia fusca, Lasioptera tibialis, Lobopteromyia venae, Dicrodiplosis venitalis and Diadiplosis buscki.

May or June Beetles. New York Farmer, September 17, 1914, page 2

A brief notice of the abundance of June beetles last spring, giving directions for evading the anticipated injury of next season.

Grass and Grubs. New York Farmer, October 15, 1914, page 8

Examination of grasslands for white grubs is advised and directions are given for avoiding serious losses in badly infested mowings.

ADDITIONS TO THE COLLECTIONS, OCTOBER 16, 1913–OCTOBER 15, 1914

The following is a list of the more important additions to the collections.

DONATION

Hymenoptera

Vespa crabro Linn., European hornet, adult and work on birch twig, December 16, January 14, Charles Goodyear, Tarrytown. Same, work on white birch, August 26, F. M. Jeffries, New York City. Through State Department of Agriculture

Isosoma orchidearum Westw., Cattleya or orchid Isosoma, infested buds, larvae, pupae and adults on Cattleya, July 2, Albert Moore, Mount Kisco

Aphelinus fuscipennis How., San José scale parasite, December 5, Vincent Phelps, Newburgh. Same, infesting San José scale on Symphorocarpus, December 8, M. C. Albright, Salisbury, Md. Same, on San José scale, December, Frank Kingman, Schodack; Mrs John Budd, Schodack; Dr Edward Masten, Schodack; F. T. Niles, Mamaroneck

Prospaltella perniciosi Tower, on San José scale, December, Frank Kingman, Schodack; Mrs John Budd, Schodack; Dr Edward Masten, Schodack; F. T. Niles, Mamaroneck

Megarhyssa atrata Linn., black long sting, adult on maple, June 13, W. A. Guernsey, Saratoga Springs

M. lunator Fabr., lunate long sting, adult, August 6, Mrs E. J. Bailey, Coeymans

Rhodites rosifolii Ckll., lenticular rose gall, on Rosa blanda, September 8, Mrs E. P. Gardner, Canandaigua

R. globuloides Beutm., globose rose gall, on Rosa blanda, September 8, Mrs E. P. Gardner, Canandaigua

R. dichlocerus Harr., long rose gall, on Rosa blanda, September 8, Mrs E. P. Gardner, Canandaigua

Aylax pisum Walsh, galls on Lygodesmia juncea, October 15, E. Bethel, Denver, Col.

Diastrophus fusiformans Ashm., gall on blackberry, September, S. H. Burnham, Hudson Falls

D. nebulosus O. S., adults and galls on blackberry, May 5, J. James de Vyver, Mount Vernon

Callirhytis cornigera O. S., gall on Quercus palustris, May 20, R. S. Walker, Chattanooga, Tenn.

C. palustris O. S., galls, April 30, J. A. Berby and H. L. Parker, Clemson College, S. C.

C. punctata Bass., knotty oak gall, adults and galls on Quercus, May 5, J. James de Vyver, Mount Vernon

C. seminator Harr., wool sower gall, galls on Quercus, April 30, J. A. Berby and H. L. Parker, Clemson College, S. C.

Amphibolips confluens Harr., oak apple gall, galls on Quercus, April 30, J. A. Berby and H. L. Parker, Clemson College, S. C.

A. inanis O. S., empty oak apple, galls on Quercus, J. A. Berby and H. L. Parker, Clemson College, S. C.

Holcaspis globulus Fitch, bullet gall, galls on Quercus, April 30, J. A. Berby and H. L. Parker, Clemson College, S. C.

Dryophanta echinus O. S., galls on Quercus agrifolia, August 23, E. Bethel, San José, Cal.

Neuroterus noxiosus Bass., noxious oak gall, adults and young, on Quercus, May 5, J. James de Vyver, Mount Vernon. Same, galls and adult on Quercus, July 10, J. W. Sherwood, Spring Valley

Hylotoma pectoralis Leach, larvae on white birch, W. C. Rice, Birch Island, Upper Saranac. Through State Conservation Commission

Pteronus integer Say, currant stem borer, larvae on currant, August 6, H. J. Carbary, Childwold

P. ventralis Say, yellow-spotted willow slug, larvae on willow, August, H. C. Sands, Lynbrook

Lophyrus abbotii Leach, Abbott's pine sawfly, larvae on pine, September 30, A. W. Butler, Mount Kisco

Coleoptera

Dendroctonus terebrans Oliv., turpentine bark beetle, workings in pine, June 4, G. W. Newman, Waverly

Phloeosinus dentatus Say, red cedar bark beetle, larvae and work on red cedar, June 15, J. J. Levison, Brooklyn, also adults and work, September 8

Xyleborus celsus Eich., Ambrosia beetle, adult on hickory, May 5, J. James de Vyver, Mount Vernon

Cryptorhynchus lapathi Linn., mottled willow and poplar curculio, on poplar, July 11, F. Pomeroy, Cooperstown

Pomphopoea sayi Lec., Say's blister beetle, adult, June 8, H. A. Van Fredenberg, Port Jervis. Same, June 13, A. J. Wiltsie, Feura Bush. Same, June 13, C. Seeber, Canajoharie. Same, adults on locust, June 13, Miss Hazel C. Ritter, Little Falls. Same, adults destroying bean blossoms, June 17, J. H. Feily, Rensselaer

Nyctobates pennsylvanica De G., adult on hickory, May 5, J. James de Vyver, Mount Vernon

Bruchus hibisci Oliv., in seeds of Hibiscus militaris, January 13, A. B. Stout, New York City

Galerucella luteola Müll., elm leaf beetle, adult, May 11, G. C. Hubbard, Red Hook. Same, May 18, C. C. Marshall, Millbrook. Same, May 25, Mrs Douglas Merritt, Rhinebeck. Same, adults and eggs on elm, June 5, L. A. Tate, Gloversville. Same, eggs and larvae on elm, June 12, M. W. Blackman, Syracuse

Diabrotica duodecimpunctata Oliv., 12-spotted Diabrotica, September 11, Benjamin Hammond, Illinois

Gastroidea cyanea Melsh., adults, May 5, J. James de Vyver, Mount Vernon

Nodonota puncticollis Say, adults on rose, June 16, Mrs W. H. Crittenden, Cornwall

Typophorus canellus Fabr., strawberry root worm, work on strawberry, August, L. C. Griffith, Lynbrook. Through State Department of Agriculture

Fidia cana Horn, adult on grape, May 16, David Hunter, San Antonio, Texas

Saperda calcarata Say, poplar borer, larva and work on Lombardy poplar, April 24, M. P. Slade, Mount Kisco

Graphisurus fasciatus De G., on hickory, June 22, J. James de Vyver, Mount Vernon

Hetoemis cinerea Oliv., on mulberry, June 22, J. James de Vyver, Mount Vernon

Monohammus confusor Kirby, sawyer, on balsam, July 20, William Kelly, Blue Mountain Lake

Elaphidion villosum Fabr., maple and oak twig pruner, larvae and work on hickory, June 2, A. C. Armstrong, Warner. Same, grubs and work on oak, July 3, F. G. Rosenbaum, New York City. Same, July 7, W. D. Davies, New York City. Same, July 8, A. S. Goodwin, New York City. Same, July 13, H. P. Moore, White Plains. Same, larvae on oak, July 21, H. W. Gordinier & Sons, Troy. Same, July 24, C. K. Carpenter, New York City. Same, July 24, Mrs John T. D. Blackburn, Crater Club, Essex County. Same, July 30, R. D. Chipp, Nyack

Callidium antennatum Newm., blue pine borer, on spruce, June 26, Miss Gertrude Lansing, Ogunquit, Me.

Osmoderma scabra Beauv., rough flower beetle, larvae at base of decaying oak posts, October 14, J. M. Taylor, Albany

Ligyrus relictus Say, June, J. James de Vyver, Bronxville

Lachnosterna arcuata Sm., June, J. James de Vyver, Bronxville

L. barda Horn, June, J. James de Vyver, Bronxville

L. dubia Sm., June 10, F. H. Lacy, Boston Corners. Same, adult, June 25, Roy Latham, Orient

L. fusca Froh., June beetle, May 19, Gilbert Tucker, Altamont. Same, adult, June 25, Roy Latham, Orient. Same, June, J. James de Vyver, Bronxville

L. micans Knoch., May 22, D. T. Marshall, Hollis. Same, June, J. James de Vyver, Bronxville

L. hirticula Knoch., June, J. James de Vyver, Bronxville. Same, adult, June 25, Roy Latham, Orient

L. fraterna Harr., May 22, D. T. Marshall, Hollis. Same, June, J. James de Vyver, Bronxville. Same, adult, June 19, F. H. Lacy, Boston Corners

L. crenulata Froh., June, J. James de Vyver, Bronxville

L. tristis Fabr., adult, June 25, Roy Latham, Orient

L. crassissima Blanch., L. implicita Horn, L. vehemens Horn, L. arcuata Sm., L. hirticula Knoch., L. gibbosa Burm., L. inversa Horn, L. bipartita Horn, L. congrua Lec., L. torta Lec., L. affinis Lec., L. crenulata Froh., January 28, J. J. Davis, Lafayette, Ind.

Diplotaxis tristis Kirby, May 22, D. T. Marshall, Hollis. Same, June, J. James de Vyver, Bronxville

Macrodactylus subspinosus Fabr., rose chafer, adults on peaches, June 16, G. P. Le Brun, Far Rockaway. Same, adults destroying strawberries, June 17, G. M. Tucker jr, Glenmont. Same, adults, June 21, George Sihairer, Scotia

Serica iricolor Say, adult on oak, June 3, Samuel Riddell, Huntington

S. sericea Ill., adult, June 25, Roy Latham, Orient

Lyctus planicollis Lec., powder post beetle, adults on ash, March 12, Hermann Von Schrenk, St Louis, Mo.

L. opaculus Lec., powder post beetle, adults, May 23, G. E. Cogswell, Jamaica

Sitodrepa panicea Linn., drug store beetle, adult, June 19, H. A. Branion, Chatham

Chauliognathus pennsylvanicus De G., adult, September 3, T. L. Cole, Catskill

Agrilus bilineatus Web., two-lined chestnut borer, work in oak, November 24, J. J. Levison, Brooklyn

A. otiosus Say, work on dogwood, March 9, N. C. Peck, Hartsdale

A. anxius Gory, bronze birch borer, work on black birch, September 9, J. J. Levison, Brooklyn

Glischrochilus quadriguttatus Fabr., adults on melon plant, July 20, E. A. Baldwin, Schenectady

Attagenus piceus Oliv., black carpet beetle, adults, May 7, H. N. Armer, Kingston

Staphylinus maculosus Grav., rove beetle, adult, March 6, David Harrison, Staatsburg

Diptera

Culex subcantans Felt, adult, July 7, Townsend Cox jr, Setauket

Cecidomyia serotinae O. S., gall on wild cherry, January 19, Fisher's Island. Through State Department of Agriculture

Cecidomyia sp., gall on Laportea canadensis, July 6, S. H. Burnham, Hudson Falls

Itonida foliora Rssl. & Hkr., gall on Quercus, September, S. H. Burnham, Hudson Falls

Obolodiplosis robiniae Hald., gall on Robinia, August 25, Roy Latham, Orient

Arthrocnodax carolina Felt, May 25, E. A. Mac Gregor, Mound, La.

Hormomyia crataegifolia Felt, gall on Crataegus coloradensis, July 7, E. Bethel, Denver, Col.

Caryomyia caryae O. S., gall on Carya, September, S. H. Burnham, Hudson Falls

? Contarinia negundifolia Felt, galls on Acer negundo, July 12, A. Cosens, Toronto, Can.

Thecodiplosis pini-radiatae Snow & Mills, galls on Pinus radiata, August 23, E. Bethel, Burlingame, Cal. Same, September 18, V. L. Kellogg, Stanford University, Cal.

Cincticornia pilulae Walsh, gall on Quercus, September 22, Roy Latham, Orient

Rhopalomyia anthophila O. S., gall on Solidago, September 22, Roy Latham, Orient

R. betheliana Ckll., galls on Artemisia filifolia, October 15, E. Bethel, Denver, Col.

R. racemicola O. S., gall on Solidago, September 22, Roy Latham, Orient

R. solidaginis Lw., gall on Solidago, September, S. H. Burnham, Hudson Falls

Sackenomyia viburnifolia Felt, gall on Viburnum, September 22, Roy Latham, Orient

Phytophaga rigidae O. S., galls on willow, April 29, A. Cosens, Toronto, Can.

Oligotrophus salicifolius Felt, gall on Salix humilis, July 12, A. Cosens, Toronto, Can. Same, gall on willow, September 22, Roy Latham, Orient

Lasioptera corni Felt, gall on Cornus, September, S. H. Burnham, Hudson Falls

L. desmodii Felt, gall on Canadian tick trefoil, September 8, Mrs E. P. Gardner, Canandaigua

L. farinosa Beutm., gall on Rubus, September 22, Roy Latham, Orient

L. lycopi Felt, gall on Lycopus, September 22, Roy Latham, Orient

Neolasioptera clematidis Felt, gall on Clematis, September, S. H. Burnham, Hudson Falls

N. erigerontis Felt, gall on Erigeron, June 25, Roy Latham, Orient

Cystiphora canadensis Felt, gall on Prenanthes, August 25, Roy Latham, Orient

Dasyneura communis Felt, galls on maple, June 18, Mrs Charles L. Seeger, Patterson. Same, June 19, S. H. Burnham, Hudson Falls

D. parthenocissi Steb., gall on woodbine, June 26, A. E. Stene, Kingston, R. I.

D. pyri Bouché, pear leaf-curling midge, adults on pear, November, F. V. Theobald, Wye, Kent, England

D. rodophaga Coq., larvae on rose, August 10, C. G. Hewitt, Ottawa, Que.

Rhabdophaga salicifolia Felt, gall on hardhack, August 18, W. E. Britton, Essex, Conn. Same, September, S. H. Burnham, Hudson Falls

Winnertzia hudsonica Felt, gall on Crataegus, September, S. H. Burnham, Hudson Falls

Agromyza aristata Malloch & Hart, paratype, May 11, J. R. Malloch, Havana, Ill.

Eristalis tenax Linn., drone fly, rat-tail larva from stock well, September 18, Miss Helen E. Bradley, Cato

Scenopinus fenestralis Linn., carpet fly, larva under carpet, February 7, Mrs Horace L. Greene, Fort Plain

Lepidoptera

Papilio troilus Linn., green-clouded swallowtail, larva on Benzoin odoriferum' September 28, C. C. Hodges, Utica

Eurymus philodice Godart, adults, September 18, Miss Helen E. Bradley, Cato

Euvanessa antiopa Linn., spiny elm caterpillar, larvae, June 10, E. T. Brackett, Saratoga Springs. Same, larvae on elm, June 12, Austin Wadsworth, Geneseo. Through State Department of Agriculture. Same, adult, August 11, J. M. Thomas, Yonkers

Sphecodina abbotii Swain, Abbott's sphinx, larvae on grape, July 24, D. T. Marshall, Hollis. Same, adult, July 31, A. J. Woodward, Hadley

Pholus achemon Dru., larva, July 21, C. M. Briggs, Chicago, Ill. Through J. Eyer

Paonias myops Sm. & Abb., adult, June 24, C. H. Peck, Menands

Halisidota caryae Harr., adult on maple, August 8, F. J. Whaley, Rensselaerville

Macronoctua onusta Grt., larvae on Iris, August 12, Mrs C. H. Van Orden, Catskill

Agrotis scandens Riley, climbing cutworm, larvae on corn, June 25, M. R. Audubon, Salem

Mamestra picta Harr., zebra caterpillar, larva on Japanese Iris, July 14, G. C. Howard, Garden City. Through Doubleday, Page & Co.

Heliophila unipuncta Haw., army worm, larvae on grasses, July 18, D. T. Marshall, Hollis. Same, adult, September 2, Howard Travell, New York City

Xylina antennata Walk., green fruit worm, adults, March 31, April 1 and April 18, E. B. Jausen, Kingston. Same, June 5, L. A. Tate, Gloversville. Same, larvae on elm, June 12, Austin Wadsworth, Geneseo. Through State Department of Agriculture

Heliothis armiger Hübn., cutworm, larvae on corn, July 30, A. T. Ogden, Kinderhook. Same, larva and work on corn, October 29, F. J. Ganong, Crafts. Same, larvae on corn, August 12, R. D. Chipp, Nyack

Abrostola triplasia Linn., dark spectacle, pupa on Magnolia, March 20, P. L. Huested, Blauvelt. Through M. M. Kennedy

Alabama argillacea Hübn., cotton moth, adults, September 25 and October 20, M. S. Baxter, Rochester. Same, adults, September 25, C. C. Laney, Rochester

Datana integerrima Grt. & Rob., black walnut caterpillar, exuviae on black walnut, August 24, T. J. Wade, New Rochelle

Euproctis chrysorrhoea Linn., brown-tail moth, winter nests, January 2, Fisher's Island. Through State Department of Agriculture

Malacosoma americana Fabr., apple tent caterpillar, eggs on apple, January 31, S. B. Van Patten, Union. Same, March 4, E. Lyon, Katonah. Same, larvae, May 5, Leonard Barron, Garden City. Same, larvae and tent, May 18, J. O. Van Clefe, Oakdale, L. I. Same, adult, June 5, L. A. Tate, Gloversville. Same, cocoon, July 15, W. S. Lodge, Chilson Lake. Same, egg masses, August 31, J. J. Hicks, Jericho

M. disstria Hübn., forest tent caterpillar, larvae, May 28, Miss Eliza S. Blunt, New Russia. Same, larvae on elm, June 12, Austin Wadsworth, Geneseo. Through State Department of Agriculture. Same, adults, June 16, J. W. Nichols, Saratoga Springs. Same, cocoon on pine, June 17, J. E. Riley. Through State Conservation Commission. Same, cocoons and cast skins, June 18, Beekman Winthrop, New York City. Same, cocoons and old egg belts, June 20, Miss Eliza S. Blunt, New Russia. Same, larvae and cocoons, July 1, J. L. Leavitt, Russell. Same, larvae and cocoons, July 3, Frank Owens, Horicon. Same, larvae, July 4, John Janack, jr, Wanakena. Same, cocoons, July 7, F. S. Witherbee, Port Henry. Same, July 7, Michael Ahearn, Clayburgh. Same, cocoons, July 15, C. A. Phelps, Canton. Same, exuviae on sugar maple, September 8, Mrs C. McClellan Smith, Cambridge

Paleacrita vernata Peck, spring canker worm, June 7, C. L. Morey, Greenwich. Same, work, June 22, J. James de Vyver, Mount Vernon

Eustroma diversilineata Hübn., larvae on woodbine, June, H. H. Horner, Albany

Erannis tiliaria Harr., 10-lined inch worm, June 7, C. L. Morey, Greenwich

Cingilia catenaria Dru., September 22, Roy Latham, Orient

Thyridopteryx ephemeraeformis Haw., bagworm, bag on apple, March 26, J. H. Dodge, Nebraska. Same, on Styrax, August 4 and 12, Millers Nursery, South Jamaica. Through State Department of Agriculture

Sibine stimulea Clem., saddle-back caterpillar, larva on oak, October 16, Miss Margaret George, Yonkers

Prolimacodes scapha Harr., Skiff Limacodes, larvae on flowering crabapple, October 6, L. C. Griffith, Lynbrook. Through State Department of Agriculture

Zeuzera pyrina Linn., leopard moth on apple, December 16, Charles Goodyear, Tarrytown. Same, work on linden, September 11, C. E. Mager, New York City

Prionoxystus robiniae Peck, larva, July 20, R. W. Braucher, Western Maryland

Podosesia syringae Harr., ash borer, adult, larvae and exuviae on ash, October 5, F. J. Seaver, New York City

Phlyctaenia ferrugalis Hübn., greenhouse leaf-tyer, adults on Chrysanthemum, December 2, C. H. Zimmer, Lynbrook. Through State Department of Agriculture. Same, larva on Marsh field fern, June 19, S. H. Burnham, Hudson Falls

Crambus caliginosellus Clem., sooty Crambus, larvae on corn, June 12, F. H. Lacy, Millerton. Same, larva, June 24, H. W. Pulver, Pine Plains. Same, larvae on corn, July 6, E. W. Conklin, Salt Point

Dioryctria reniculella Grote, spruce cone worm, larvae in spruce cones, July 8, S. J. Clark, Mount Vernon

Tmetocera ocellana Schiff., bud moth on cherry buds, April 8, J. H. Livingston, Tivoli

Archips cerasivorana Fitch, ugly nest cherry worm, larvae, July 7, W. H. Bradford, Ellenville. Same, adults, July 7, A. S. Callan, Chatham

A. fervidana Clem., larvae on oak, July 14, Alfred Waterman, Twaddell Point Station, East Branch

Tortrix fumiferana Clem., spruce bud worm, pupae on spruce, June 1, S. G. Harris, Tarrytown. Same, larvae on spruce, June 3, Mrs E. C. Whitinger, Schenectady. Same, larvae on blue spruce, June 4, W. G. Stoneman, Albany. Same, pupae in hemlock and balsam, June 25, Miss Edith M. Patch, Orono, Me. Same, larvae on spruce, July 7, Robert Parmelee, Oswegatchie

Dichomeris marginellus Fabr., Juniper webworm, cocoon and work on Swedish Juniper, December 15, Isaac Hicks & Son, Westbury. Same, larva on Juniper, April 11, H. W. Merkel, New York City

Coleophora limosipennella Dup., elm case-bearer, larvae on elm, June 22, J. James de Vyver, Mount Vernon. Same, July 22, G. M. Kurz, Oyster Bay

C. fletcherella Fern., cigar case-bearer, larvae on apple, June 22, J. James de Vyver, Mount Vernon

Platyptera

Corydalis cornuta Linn., Dobson fly, larvae, June 3, Irving Van Bergen, Schoharie. Same, adult, June 26, Mrs H. C. Morehouse, Howes Cave

Ephemeridae

Baetisca obesa Say, larvae May 24, C. F. Alexander, Northampton

Cleon sp., larvae from water supply, December 8, Theodore Horton, Albany

Siphlonisca aerodromia Ndh., Mayfly, larvae, May 24, C. F. Alexander, Northampton

Hemiptera

Cicada linnei Grossb., August 16, J. F. Rose, South Byron.

? Ormenis pruinosa Say, lightning leaf hopper, young on wild cherry, July 14, C. Bahnsen, Lake Placid

Aphrophora parallela Say, parallel spittle insect, nymphs on pine, July 3, J. H. Smith, Chestertown

Bythoscopus franciscanus Baker, June 21, E. P. Van Duzee, La Jolla, Cal.

Thamnotettix heidemanni Ball., June 21, E. P. Van Duzee, La Jolla, Cal.

Alebra albostriella Fall., on Norway maple, July 16, C. C. Lawrence, Newburg. Through Frost & Bartlett Co.

Pachypsylla venusta O. S., gall on Celtis reticulata, December 1, E. Bethel, Denver, Col.

Phylloxera caryaecaulis Fitch, hickory gall aphid, gall, June 23, Miss A. K. Hays, South Nyack. Same, July 2, Stamford, Conn. Through Frost & Bartlett Co.

Chermes floccus Patch on spruce, December 16, Mrs Openhyme, St Huberts. Through State Department of Agriculture

C. abietis Linn., spruce gall aphid on spruce, January 14, Charles Goodyear, Tarrytown. Same, galls on spruce, August 6, Arthur Dummett, Mount Vernon. Same, on spruce, September 2, G. L. Barrus, Lake Placid Club, Essex Co.

C. strobilobius Kalt., woolly larch aphis, eggs on pine, May 4, Walter Luke, New York City. Same, eggs and young on larch, May 5, A. J. Seaver, New York City

C. cooleyi Gill., aphid spruce gall, gall on spruce, July 7, John Nill, Watertown

C. pinicorticis Fitch, pine bark aphid, adults and young on white pine, May 3, A. G. Foord, Kerhonkson

Pemphigus populi-globuli Fitch, galls on Lombardy poplar, June 18, T. J. Wade, New Rochelle

Colopha ulmicola Fitch, cockscomb elm gall, galls on elm, July 1, Edwin Lyon, Katonah

Schizoneura lanigera Hausm., woolly aphis on elm leaves, June 5, L. A. Tate, Gloversville. Same, June 9, J. H. Livingston, Tivoli. Same, June 10, J. D. Judson, Vernon. Same, adults and young on elm leaves, June 20, Miss Eliza S. Blunt, New Russia. Same, June 22, Miss Alice C. Hereford, Watertown. Same, adult on slippery elm, June 23, W. W. Howell, Poughkeepsie. Same, July 5, Mrs Horace L. Greene, Fort Plain

Phyllaphis fagi Linn., woolly beech leaf aphis, adults and young on beech, September 19, Naramore & Young, Rochester

Chaitophorus aceris Linn., Norway maple plant louse, adults on Norway maple, July 9, Miss Emily F. Becker, Catskill

Drepanosiphum acerifolii Thos., on maple, May 25, M. J. Naramore, Ossining

Mindarus abietinus Koch., balsam aphid, work on balsam, July 7, John Nill, Watertown

Aphis sorbi Kalt., rosy aphis, adult and young, July 2, J. R. Heilman, Poughkeepsie

Myzus cerasi Linn., black cherry aphis, adult on cherry, June 23, W. W. Howell, Poughkeepsie

Paraleyrodes mori Quaint., adults on Kalmia, July 3, H. W. Niles, Mount Kisco

Kermes pubescens Bogue, on white oak, May 14, G. B. King, Lawrence, Mass.

K. cockerelli Ehrh., on Quercus kelloggi, May 14, G. B. King, Lawrence, Mass.

K. nivalis King & Ckll., on Quercus rubra, May 14, G. B. King, Lawrence, Mass.

K. essigii King, on Quercus agrifolia, May 14, G. B. King, Lawrence, Mass.

Physokermes piceae Schr., spruce bud scale, adults and young on Norway spruce, July 7, F. S. Witherbee, Port Henry. Same, galls on spruce, August 6, Arthur Dummett, Mount Vernon

Pseudococcus ledi Ckll., scale on Ledum groenlandicum, August, H. D. House, near Oneida, Madison county

Pulvinaria vitis Linn., cottony maple scale, adult on grape, May 9, E. Bunn, Yonkers. Same, egg sacks on maple, July 14, Alfred Waterman, Twaddell Point Station, East Branch

Gossyparia spuria Mod., elm bark louse on elm, December 16, Charles Goodyear, Tarrytown. Same, female on elm, June 18, F. L. Mead, Mechanicville. Same, on elm, July 22, G. M. Kurz, Oyster Bay

Phenacoccus acericola King, false maple scale, young on sugar maple, April 24, J. D. Turner, Kingston. Same, adults on sugar maple, September 2, Benjamin Hammond, Fishkill

Phenacaspis mischocarpi Ckll. & Rob., on Mischocarpus, June 24, T. D. A. Cockerell, Los Banos, P. I.

Protopulvinaria longivalvata bakeri Ckll., June 24, T. D. A. Cockerell, Los Banos, P. I.

Eulecanium nigrofasciatum Perg., black-banded scale, young scales on Sycamore, December 30, J. J. Levison, Brooklyn. Same, young on sugar maple, November 19, New York Farmer, Port Jervis

E. tarsale Sign., soft scale on dogwood, December 16, Charles Goodyear, Tarrytown

E. tulipiferae Cook, tulip tree scale, adults on tulip tree, July 30, J. H. Livingston, Tivoli

Neolecanium sallei Sign., Lecanium scale, adult on Erythrina sp., February, Dr W. M. Wheeler, San Lucas Toliman, Guatemala

Icerya purchasi Mask., cottony cushion scale, adults and young on Acacia, October 23, L. C. Griffith, Lynbrook

Chionaspis americana Johns., scurfy elm scale, eggs on elm, October 17, J. J. Levison, Brooklyn. Same, eggs on Ulmus americana, November 7, Hicks Nurseries, Westbury. Same, on elm, December 16, Charles Goodyear, Tarrytown. Same, June 2, D. Kraisman, Brooklyn. Same, young on elm, July 8, F. J. Whaley, Albany

C. furfura Fitch, scurfy scale on pear, December 16, Charles Goodyear, Tarrytown. Same, eggs on apple, March 26, F. H. Lacy, Poughkeepsie. Same, eggs on pear, April 20, James Fulton, Hayworth, Ill. Through Benjamin Hammond, Fishkill

C. corni Cooley, on Cornus, December 5, Isaac Hicks & Son, Westbury

C. euonymi Comst., Euonymus scale, on shrubs and vines, December 16, Charles Goodyear, Tarrytown. Same, adults and young, on Euonymus radicans, February 24, J. C. MacGregor, Mount Kisco. Through State Department of Agriculture. Same, on Euonymus and Celastrus, January 14, Charles Goodyear, Tarrytown

C. pinifoliae Fitch, pine leaf scale, eggs on pine, April 16, H. W. Merkel, New York City. Same, eggs on Pinus cembra, May 2, S. G. Harris, Tarrytown

Hemichionaspis uvariae Ckll. & Rob., on Uvaria, June 24, T. D. A. Cockerell, Los Banos, P. I.

Diaspis carueli Targ., Juniper scale, adults on Juniperus virginiana, November 7, Hicks Nurseries, Westbury. Same, adult on red cedar, March 16, J. J. Levison, Brooklyn. Same, eggs on cedar, April 16, H. W. Merkel, New York City

Aulacaspis rosae Sandberg, rose scale on rose, December 19, H. W. Gordinier & Sons, Troy

Odonaspis schizostachyi Ckll. & Rob., on Schizostachyum, June 24, T. D. A. Cockerell, Los Banos, P. I.

Aspidiotus abietis Schr., hemlock scale on hemlock, January 14, Charles Goodyear, Tarrytown. Same, eggs on hemlock, April 16, H. W. Merkel, New York City

A. ancylus Putn., Putnam scale, adults on linden, July 8, F. J. Whaley, Albany

A. hederae Vall., white scale, adults on Cattleya, July 2, Mount Kisco. Through Albert Moore

A. perniciosus Comst., San José scale on weeping cherry, December 16, Charles Goodyear, Tarrytown

A. rapax Comst., greedy scale, adult on Baytree, November 11. Through State Department of Agriculture

Lepidosaphes ulmi Linn., oyster shell scale, eggs on apple, April 8, Mrs W. E. Kerin, Troy. Through H. W. Gordinier. Same, eggs on lilac, May 11, Miss M. L. McMaster, Greenwich. Same, eggs and young, June 26, C. P. Cassidy, Poultney, Vt.

Chlorochroa uhleri Stal. Juniper plant bug, adults on corn, September 11, Miss M. S. Soule, Quaker Street, also nymphs and adults, August 23

Euschistus variolarius Pal. Beauv., adults, August 23, Miss M. S. Soule, Quaker Street

Arilus cristatus Linn., wheel bug, eggs, December 22, Maryland. Through State Department of Agriculture

Paracalocoris scrupeus Say, nymphs, June 3, L. F. Strickland, Lockport

Neurocolpus nubilis Say, adult on sumac, July 7, L. F. Strickland, Lockport

Lygidea mendax Reut., false red bug, work on apple, June 12, C. R. Shons, Washingtonville. Same, on apple, June 19, E. S. Gregory, Niverville. Same, work on apple leaves, June 22, J. James de Vyver, Mount Vernon. Same, work, July 2, J. R. Heilman, Poughkeepsie. Same, July 6, C. H. Duell & Son, Bangall. Same, July 8, F. H. Lacy, Poughkeepsie, also adults, July 10, Hyde Park

Orthoptera

Melanoplus femoratus Burm., two-striped grasshopper, adult, September 29, Miss May C. Bradley, Cato

M. femur-rubrum DeG., red-legged grasshopper, adult, September 29, Miss May C. Bradley, Cato

Encoptolophus sordidus Burm., sordid grasshopper, adult, September 29, Miss May C. Bradley, Cato

Thysanura

Lepisma domestica Pack., silver-fish or slide, adult, March 25, D. H. Cox, New York City

Lipura ambulans Linn., in greenhouse soil, February 5, William Harris, Saratoga Springs

PURCHASE

Kny-Scheerer Company, New York City

Lepidoptera (butterflies and moths)

Ornithoptera zalmoxis, Africa
O. hekuba, pair, North Australia
Papilio blumei, Celebes
Teniopalpus imperialis, female, Assam
Papilio rhodifer, Andaman Islands
P. agenor, Assam
Morpho anaxibia, Brazil
Attacus atlas, male, Sumatra
Brahmea whitei, female, Canton
Thysania agrippina, Brazil
Geometrid, showing protective coloration, India
Erebus odora, Cuba
Ophideres aurantia, Queensland
Ornithoptera rhadamanthus, pair, India
Morpho sulkowskyi, Columbia
Stichophthalma camadera, India
Thaumantis diores, India

Papilio majo, Andaman Islands
Eploe vestigiata, India
Bunnaea caffraria, Kamerum
Hyperchiria janus, pair, Mexico
Epiphora banhiniae, female, Africa
Nudaurelia ringleri, Africa
Gynanisa maja, Natal
Phyllodes sp., India
Graellsia isabellae, pair, Europe
Ornithoptera lydius, pair
Morpho polyphemus, Mexico
Ornithoptera urvilleana, pair

Coleoptera (beetles)

Catoxantha opulenta, India
Mormolyce phyllodes, India
Odontolabis lowei, Borneo
Calosoma sycophanta, Germany
Chrysina macropus, male, Mexico
Chrysaspis speciosa var. fastuosa
Chiasognathus granti, male, South America
Ateuchus sacer, North Africa
Entimus imperialis, Brazil
Lamprina aurata
Plusiotus resplendens, Chiriqui
Xyllorhiza adusta, India
Goliathus regius, Africa
Euchirus longimanus, Australia
Dynastes neptum
Goliathus giganteus, male, Kamerun
Lithinus nigrocristatus and lichen on which the beetle lives, Madagascar
Batocera ulma, pair
B. armata, pair
Megosoma elephas, male, Central America
Golofa porteri, pair, Venezuela
Euchroma gigantea, Panama
Dictyophorus reticulatus, Florida

Orthoptera (grasshoppers, walking sticks, etc.)

Giant cockroach, Amazon River
Phyllium siccifolium
Phryganistria fruehstorferi, Assam
Temera imperialis, Tonkin
Timanthes brunni, Tonkin
Giant grasshoppers
Gryllotalpa sp., Porto Rico

Riker mounts and life histories

Asta, large honey bee
Smaller, red wood ant
Trochilium apiformis
Arctia caja
Coccinella septempunctata
Dissosteira carolina
Periplaneta americana
Murgantia histrionica
Neoclytus erythrocephalus
Pelidnota punctata
Alsophila pometaria
Agrotis ypsilon
Melittia satyriniformis
Noctua c-nigrum
Bombus terricola
Cimbex americana

EXCHANGE

There were received from Prof. S. I. Kuwana of the board of plant inspection, Imperial Ministry of Agriculture and Commerce, Tokio, Japan, specimens of the following Coccidae.

Aspidiotus bambusarum Ckll., A. cryptomeriae Kuw., A. paeoniae Ckll., A. secreta Ckll., Chionaspis bambusae Ckll., C. citri Comst., C. hikosani Kuw., C. kiushiuensis Kuw., Lepidosaphes crawii Ckll., L. uniloba Kuw., Parlatoria ziziphus Lucas, Ischnaspis longirostria Sign., Leucaspis japonica Ckll., Pulvinaria citricola Kuw., P. hazae Kuw., P. horii Kuw., P. idesiae Kuw., P. oyamae Kuw., P. photiniae Kuw., Lecanium glandi Kuw., L. kunoensis Kuw., L. nishigaharae Kuw., Aclerda tokionis Ckll., Lecaniodiaspis quercus Ckll., Ericerus pela West., Eriococcus lagerstroemiae Kuw., Antonina crawi Ckll., Kermes vastus Kuw., Takahashia japonica Ckll., Icerya okodae Kuw. equals I. seychellarum West.

The Tasmanian Coleoptera listed below were received January 5th, through G. H. Hardy, secretary of the Tasmanian Museum and Botanical Gardens.

Prynus scutellaris *Fabr.*
Paropsis lineata *Marsh.*
P. serpiginosa *Er.*
P. nigerrima *Germ.*
Xanthophaea angustula *Chd.*
Trigonothrops longiplaga *Chd.*
Adelium abreviatum *L.*
Sarothrocrepis callida
Angonocheila curtula *Er.*
Natalis porcata *Fabr.*
Euchoptera apicalis *Saund.*
Lagria grandis *Gyllh.*
Haltica pagana *Bl.*

From C. W. Johnson, Boston, Mass., a series of 83 species determined by this well-known authority on two-winged flies, and comprising a notable addition to the State collection. The numerals preceding the names indicate the number of specimens.

4 Odontomyia microstoma *Lw.*
4 Beris annulifera *Bigot.*
1 Scoliopelta luteipes *Will.*
2 Geosargus elegans *Lw.*
4 Hermetia illucens *Linn.*
4 Oxycera unifasciata *Lw.*
4 Nemotelus canadensis *Lw.*
4 N. unicolor *Lw.*
2 Chrysops sackeni *Hine*
2 C. delicatulus *O. S.*
2 C. montanus *O. S.*
2 C. pudicus *O. S.*
2 C. fallax *O. S.*
4 C. obsoletus *O. S.*
4 Platypalpus flavirostris *Lw.*
4 P. aequalis *Lw.*
4 Drapetis spectabilis *Melander*
4 Chersodromia houghi *Melander* (Coloboneura)
4 Coloboneura inusitata *Melander*
2 Litanomyia elongata *Melander*
2 Hemerodromia scapularis *Lw.*
4 Clinocera simplex *Lw.*
3 Syneches rufus *Lw.*
2 Empis distans *Lw.*
2 E. humilis *Lw.*
2 E. tridentata *Coq.*
2 E. loripedis *Coq.*
2 E. obesa *Lw.*
4 E. spectabilis *Lw.*
2 Hilara tristis *Lw.*
4 H. umbrosa *Lw.*
2 Oreogeton obscura *Lw.*
4 Rhamphomyia candicans *Lw.*
2 R. irregularis *Lw.*
2 R. luteiventris *Lw.*
2 R. mutabilis *Lw.*
2 R. glabra *Lw.*
4 R. umbilicata *Lw.*
4 R. gracilis *Lw.*
4 R. pulla *Lw.*
4 Dolichopus palaestricus *Lw.*
2 Pelastoneura cognatus *Lw.*
2 Gymnopternus laevigatus *Lw.*
4 Argyra calcitrans *Lw.*
4 Hypocharassus pruinosus *Whlr.*
4 Hydrophorus aestuum *Lw.*
4 H. intentus *Aldrich*
4 H. chrysologus *Walk.*
2 Dichaetoneura leucoptera *Johns.*
2 Hypostena dunningii *Coq.*
4 H. floridensis *Town.*
2 Leskia analis *Say*
4 Exorista vulgaris *Fall.*
2 Sturmia inquinata *Vdw.*
2 Masicera festinans *Meign.*
2 Tachina simulans *Meign.*
4 Gonia senilis *Will.*
4 Epigrymyia floridensis *Town.*
4 Panzeria ruficauda *Brauer*
4 P. radicans *Fall.*
2 Peleteria aenea *Staeg.*
4 Melanophora roralis *Linn.*
4 Tetramerinx unica *Stein.*
4 Phyllogaster cordyluroides *Stein.*
4 Spilogaster pagana *Fabr.*
4 S. urbana *Meign.*
4 Limnophora diaphana *Weid.*
4 Fucillia marina *Macq.* (fucorum of authors not Fall.)
4 Rivellia quadrifasciata *Macq.*
4 Seoptera vibrans *Linn.*
2 Acidia fausta *O. S.*
2 Diastata vagans *Lw.*
2 Scyphella flava *Linn.*
4 Milichiella arcuata *Lw.*
4 Pholeomyia indecora *Lw.*
4 Agromyza posticata *Meign.* (A. terminalis Coq. is a synonym, according to Malloch)
2 A. parvicornis *Lw.*
2 A. melampyga *Lw.*
2 Dryomyza aristalis *Coq.*
2 Tetanocera setosa *Coq.*
3 Clusia lateralis *Walk.*
2 C. czernyi *Johns.*
2 Bittacomorpha jonesi *Johns.*

APPENDIX

A STUDY OF GALL MIDGES III

PORRICONDYLARIAE

The members of this tribe of the Itonididae may be recognized by the possession of a distinct crossvein in connection with the first tarsal segment being shorter than the second. The crossvein is so characteristic of the group that a little experience suffices to separate members from all other Itonididae except in the case of a few anomalous forms. This crossvein usually runs parallel to costa, or nearly so, though in Colpodia and its close allies the crossvein may be at a considerable angle to costa. This latter is also true, but in a different manner, in Winnertzia. Diallactes Kieff. is remarkable

Fig. 1 Winnertzia pectinata; lateral view of adult, enlarged (original)

for the possesion of a rudimentary branch near the basal third of subcosta. The third vein in this group extends well beyond the apex before fusing with costa, except in Winnertzia. The very slender, linear wings of Colpodia are unique in the family. The antennae exhibit great diversity of structure, presenting, as do other organs, types of extreme development. The stem of the flagellate segments n some males has a length three times that of the basal enlargement. The setae are extremely long and in some forms present an arrangement not far removed from the characteristic crenulate whorls found in Campylomyza. The circumfili are more aberrant than in any tribe aside from the Itonididinariae. These organs are frequently set at a considerable distance from the face of the segment, in this respect approaching Schizomyia, and display a marked tendency toward distal prolongation. This is particularly well marked in Winnertzia with its minute horseshoelike structures, nails and all, on opposite faces of the segments. The claws may be simple or unidentate and in some species are distinct y swollen subapically. The male genitalia present most striking diversities. The terminal clasp segment may be obese as in some species of Porricondyla, greatly dilated subapically as in P. hamata, or very greatly produced and slender as in Didactylomyia. The ovipositor in the female is frequently short, with the terminal lobes biarticulate, or the ovipositor may be extensile and with the biarticulate lobes subapical and dorsal as in Winnertzia.

Little is known of the life history of our American forms and there is such great diversity between the two sexes that the present classification must be regarded as largely preliminary. Most of the species presumably live in dead or decaying vegetable matter.

Key to genera

a Crossvein not parallel with costa, forming a well-marked angle therewith
- *b* Four long veins, the fifth simple, the sixth free
  - *c* Fifth vein arising from the third near the crossvein, a supernumerary vein at the basal third of subcosta .... Diallactes Kieff.
  - *cc* Fifth vein arising from the base of the wing, no supernumerary vein at the basal third of subcosta
    - *d* Fifth vein well developed; circumfili modified to form horseshoelike appendages on opposite faces of the segment
      Winnertzia Rond. (Syn. Winnertziola Kieff.)
    - *dd* Fifth vein rudimentary, obsolete basally and apically (Australian)
      Gonioclema Skuse[1]
- *bb* Three long veins, the sixth a branch of the fifth or wanting
  - *c* Wings not very long and narrow, the crossvein at an oblique angle to costa

[1] Location provisional.

d Fifth vein forked, the sixth a branch of the fifth

e Fifth vein close to the posterior margin and uniting therewith near the basal half; palpi triarticulate; terminal clasp segment short
Bryocrypta Kieff.

ee Fifth vein not close to the posterior margin, uniting therewith near the distal fourth; palpi quadriarticulate

f No supernumerary vein at base of subcosta; claws toothed; terminal clasp segment greatly produced, slender
Didactylomyia Felt

ff Supernumerary vein at base of subcosta; claws simple
Liebeliola Kieff. & Jorg.

dd Fifth vein simple, the sixth wanting

e Palpi quadriarticulate.................. Johnsonomyia Felt [1]

ee Palpi biarticulate.......................... Colomyia Kieff.

cc Wings usually very long, narrow, the crossvein almost at right angles to costa

d Fifth vein forked, the sixth a branch of the fifth; terminal clasp segment short, swollen, the claws usually simple........ Colpodia Winn.

dd Fifth vein simple, not reaching the wing margin....................
Clinophaena Kieff.

ddd Fifth vein simple, the sixth wanting (fossil)......................
Paleocolpodia Meun.

aa Crossvein parallel or nearly so with costa and apparently a continuation of the third vein

b Four long veins, the fifth simple, the sixth free

c Fifth vein not obsolete basally

d Distal portion of the abdomen not recurved dorsally

e Pulvilli longer than the unidentate claws; 16 or more antennal segments; ovipositor biarticulate.............. Asynapta H. Lw.

ee Pulvilli shorter than the simple claws; 14 antennal segments; ovipositor triarticulate.................... Clinorhytis Kieff.

dd Abdomen slender, the distal portion recurved dorsally; claws toothed, the lobes of the ovipositor biarticulate... Ruebsaamenia Kieff.

cc Fifth vein obsolete basally; abdomen greatly produced, at least three times the length of the remainder of the body..... Dicerura Kieff.

bb Three long veins, the sixth a branch of the fifth or wanting

c Fifth vein forked

d Circumfili of the male not forming long loops or bows as in the Itonidinariae

e Palpi quadriarticulate

f Antennal segments of the male greatly produced, or at least with a distinct stem

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[1] The absence of circumfili compels the reference of this genus to the Heteropezinae, though the superficial wing and antennal structures would place it here. It has therefore been included in the key simply to facilitate identification.

g Abdomen not recurved dorsally.... P o r r i c o n d y l a Rond.[1]
gg Abdomen slender, recurved dorsally..C a m p t o m y i a Kieff.
ff Antennae not greatly produced in both sexes
g Basal clasp segment ovate, denticulate apically; terminal clasp segment wanting........................D i r h i z a H. Lw.
gg Male genitalia presumably normal; flagellate antennal segments subsessile or nearly so; lobes of the ovipositor normal........ P r o d i r h i z a Kieff.
ee Palpi triarticulate..........................L o p e z i e l l a Tav.
dd Circumfili of the male forming long loops as in the Itonidinariae
e Palpi quadriarticulate...........................L o p e s i a Tav.
ee Palpi uniarticulate.............A l l o d i p l o s i s Kieff. & Jorg..
cc Fifth vein simple, the sixth wanting
d Claws denticulate, as long as the pulvilli or at most twice as long as the pulvilli.................................H o l o n e u r u s Kieff.
dd Claws toothed, more than twice the length of the pulvilli............ C o c c o p s i s Meij.

WINNERTZIA Rond.

Clinorhiza Kieff.

Winnertziola Kieff.

1860 **Rondani, C.** Atti Soc. Ital. Sci. Nat. Milano, 2:5, 8
1876 **Bergenstamm, J. E. & Low, Paul.** Syn. Cecidomyidarum, p. 24
1892 **Theobald, F. V.** Acct. Brit. Flies, 1:84
1894 **Kieffer, J. J.** Soc. Ent. Fr. Ann., 63:313, 340 (Clinorhiza and Winnertzia)
1896 ———— Berln. Ent. Zeitschr., 41:3, 4, 7, 33

[1] The divisions given below are those of Kieffer, which for the present at least, we prefer not to apply to American forms.

h Claws simple
i Pulvilli as long or a little shorter than the claws
j Flagellate antennal segments of the male globose, elongated and constricted in the middle in the female.........P o r r i c o n d y l a Rond.
jj Flagellate antennal segments elongated and subcylindrical in the two sexes..............................P h a e n e p i d o s i s Kieff.
ii Pulvilli rudimentary
j Flagellate antennal segments of the female with a stem one-half to three-fourths the length of the enlargement; lobes of ovipositor biarticulate P a r e p i d o s i s Kieff.
jj Flagellate antennal segments of the female sessile; lobes of the ovipositor very small...............................M y s o c o s m u s Kieff.
hh Claws toothed
i Pulvilli as long as the claws
j Terminal clasp segment as long as the basal clasp segment, capitate apically...............................D i c r o n e u r u s Kieff.
jj Terminal clasp segment ellipsoidal, shorter than the basal clasp segment S y n a p t e l l a Kieff.
ii Pulvilli reaching at most to the middle of the claws
j Third and fourth antennal segments fused.....S y n a r t h r e l l a Kieff.
jj Third and fourth antennal segments not fused; terminal clasp segment a little longer than its diameter, almost truncate, the margin spined P r o s e p i d o s i s Kieff.

1897	**Kieffer, J. J.**	Syn. Cecid. de Eur. & Alg., p. 47
1900	————	Soc. Ent. Fr. Ann., 69:447
1904	**Meunier, F.**	Soc. Sci. Brux. Ann., 28:8
1908	**Felt, E. P.**	N. Y. State Mus. Bul. 124:421
1911	————	N. Y. Ent. Soc. Jour., 19:39
1913	**Kieffer, J. J.**	Marcellia, 11:235 (Winnertziola)
1913	————	Gen. Insect., fasc. 152, p. 281

The peculiar venation serves at once to distinguish members of this genus. The third vein is united to subcosta by a distinct, oblique crossvein and joins the margin at or near the apex, rarely or never beyond. The fifth and sixth veins are distinct, simple. There are 13 or 14 antennal segments, sessile in the female and with an evident stem in the male. Most peculiar of all, the flagellate segments are ornamented in both sexes with very highly developed

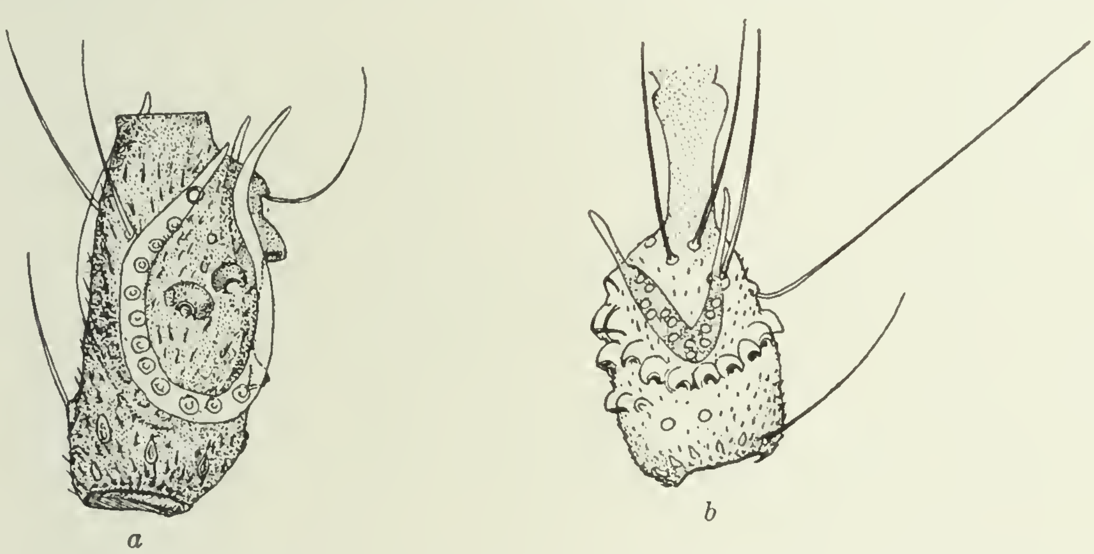


Fig. 2 Winnertzia calciequina; *a*, sixth antennal segment of female showing "horseshoe" circumfili; *b*, ninth antennal segment of male, opposite aspect from that shown in fig. 4; enlarged (original)

and peculiar circumfili. The latter resemble minute horseshoes, nails and all, fastened to opposite sides of the segment. These organs occur nearer the base of the segment in the female than in the male. The palpi are quadriarticulate, the claws toothed and the pulvilli short or rudimentary. The male genitalia have the terminal clasp segment short, stout, with a distinct apical tooth and the basal clasp segment very broad and stout. The dorsal and ventral plates are also stout. There are a series of distinct thickenings or chitinous rods (plate 5, figure 4) which give the genitalia of this genus a very characteristic appearance. The ovipositor is long, stout and with bi- or triarticulate lobes usually attached to the dorsal angle. Type Asynapta lugubris Winn. There is a good series of fine females (no males) in the Winnertz collection at the University of Bonn. Our American forms are evidently cogeneric.

Winnertziola Kieff. is placed as a synonym of Winnertzia Rond. since the differential characters do not appear to be constant in American species.

Key to species

a 13 antennal segments
  b Fifth antennal segment with a stem three-fourths the length of the basal enlargement. Abdomen yellowish brown; length 1 mm; male............ carpini Felt, C. 106
  bb Fifth antennal segment with a stem one-fifth the length of the basal enlargement. Abdomen greenish yellow; length 2 mm; female................ palustris n. sp., C. 1357
aa 14 antennal segments
  b Segments sessile or subsessile; females
    c Abdomen reddish brown; length 2 mm, the fifth antennal segment with a length one-half greater than its diameter, the fourth palpal segment one-half longer than the third.........arizonensis Felt, C. 1022
    cc Abdomen greenish yellow; length 2 mm, the fifth antennal segment with a length two and one-half times its diameter, the fourth palpal segment nearly twice the length of the third.......................... calciequina Felt, C. 673
    ccc Abdomen fuscous yellowish; length 1.5 mm; fifth antennal segment with a length two and one-half times its diameter, the fourth palpal segment one-half longer than the third; reared from decaying chestnut bark..........................pectinata Felt, C. a2109
    cccc Abdomen fuscous yellowish, length 2mm, fifth antennal segment with a length two and one-half times its diameter, fourth palpal segment with a length twice that of the third. Reared from decaying sugar maple bark......................aceris Felt, C. a2381
    ccccc Abdomen pale straw, length 2 mm, fifth antennal segment with a length twice its diameter, the fourth palpal segment one-half longer than the third.........................karnerensis Felt, C. 395
    cccccc Abdomen fuscous yellowish, length 1.5 mm, fifth antennal segment with a length two and one-half times its diameter, the fourth palpal segment twice as long as the third.............................. hudsonici Felt, C. a1555y
  bb Fifth antennal segment with a stem one-third the length of the basal enlargement; males
    c Abdomen dark yellowish brown, length 1.5 mm, the fourth palpal segment twice the length of the third..........ampelophila Felt, C. 450
    cc Abdomen dark brown, length .75 mm, the fourth palpal segment twice the length of the third...............solidaginis Felt, C. 508
  bbb Fifth antennal segment with a stem three-fourths the length of the basal enlargement; males
    c Abdomen yellowish green basally, apically light brown, length 2 mm; fourth palpal segment one-half longer than the third................ calciequina Felt, C. 561
    cc Abdomen fuscous yellowish, length 1.75 mm; the fourth palpal segment one-half longer than the third; reared from decaying chestnut bark.... pectinata Felt, C. a2109

ccc Abdomen fuscous yellowish, length 2 mm, fourth palpal segment nearly twice the length of the third. Reared from decaying maple bark....................................aceris Felt, C. a2381

cccc Abdomen dull brown, length 1.25 mm; fourth palpal segment one-fourth longer than the third........................rubida Felt, C. 300

bbbb Fifth antennal segment with a stem as long as the basal enlargement; male

c Abdomen dark brown, length 1 mm; fourth palpal segment twice the length of the third..................pinicorticis Felt, C. 1047

Winnertzia carpini Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 148–49 (separate, p. 52)
1908 ———— N. Y. State Mus. Bul. 124, p. 421

The midge was taken on ironwood, Carpinus caroliniana, at Albany, N. Y., June 1, 1906.

Male. Length 1 mm. Antennae as long as the body, thickly haired, dark brown; 13 segments, the fifth with a stem three-fourths the cylindric basal enlargement, which latter has a length twice its diameter; terminal segment with a length four times its diameter, composed of two closely fused. Palpi; the first segment with a length four times its diameter, the second twice as long, stout, the third a little longer, more slender, the fourth one-half longer than the third. Mesonotum yellowish brown, the submedian lines yellow-haired. Scutellum yellowish with a few setae apically, postscutellum darker. Abdomen yellowish brown, the basal segment and genitalia darker. Wings hyaline, costa dark brown. Halteres, coxae and femora yellowish transparent, the last slightly fuscous apically; tibiae and tarsi pale yellowish brown; claws stout, curved, unidentate, the pulvilli shorter than the claws. Genitalia; basal clasp segment short, stout; terminal clasp segment short, obese; dorsal and ventral plates broad, slightly emarginate, the lobes obliquely truncate. Type Cecid. 106.

Winnertzia palustris n. sp.

This species was taken July 10, 1909 on low vegetation at Canada Lake, town of Caroga, N. Y., by Mr C. P. Alexander.

Female. Length 2 mm. Antennae about two-thirds the length of the abdomen, thickly haired, dark brown; 13 segments, the fifth with a stem one-fifth the length of the cylindric basal enlargement, which latter has a length three times its diameter; terminal segment reduced, with a length three times its diameter, tapering to a narrowly rounded apex. Palpi; the first segment short, subquadrate, the second stout, with a length three times its diameter, the third one-half longer, more slender, the fourth one-half longer and more slender than the third. Mesonotum dull brown. Scutellum dark brown, sparsely haired, postscutellum probably dark brown. Abdomen greenish yellowish, the ovipositor fuscous. Wings hyaline, costa dark brown. Halteres yellowish transparent. Legs mostly pale

yellowish or fuscous yellowish, the tarsi mostly dark brown; claws minutely unidentate, rather long, slender, evenly curved, the pulvilli rudimentary. Ovipositor stout, about two-thirds the length of the abdomen when extended, the terminal lobes triarticulate, the third tapering to a narrowly rounded apex. Type Cecid. 1357.

Winnertzia arizonensis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 421

Described from a female taken June 12th at Williams, Ariz., by H. S. Barber.

Female. Length 2 mm. Antennae probably extending to the base of the abdomen, thickly haired, fuscous yellowish, probably 14 segments, the fifth subcylindric, with a length about one-half greater than its diameter. Palpi; the first segment short, stout, irregular, the second rather stout, with a length about three times its diameter, the third one-fourth longer and more slender and the fourth one-half longer and more slender than the third. Mesonotum, scutellum and abdomen a dull reddish brown. Wings narrow, hyaline, costa pale straw. Legs yellowish brown; claws long, stout, strongly curved, unidentate, the pulvilli shorter than the claws. Ovipositor longer than the body, the terminal lobes biarticulate, the second segment more slender, with a length about twice its diameter, broadly rounded apically. Type Cecid. 1022.

Winnertzia hudsonici Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 422

This species was reared at Albany, N. Y., July 25, 1907 from a jar containing leaves of a Crataegus bearing greenish, stout, cup-shaped, fimbriate galls (N. Y. State Mus. Bul. 175, pl. 3, fig. 16), each inhabited by one larva. The species presumably came from decaying vegetable matter.

Female. Length 1.5 mm. Antennae extending to the fourth abdominal segment, rather thickly haired, dark straw, pale yellowish basally; 14 segments, the fifth subcylindric, subsessile, with a length twice its diameter; terminal segment somewhat produced, tapering distally to a subacute apex. Palpi; the first segment long, slender, the second a little longer, stouter, slightly swollen subapically, the third one-half longer and more slender than the second, the fourth about twice the length of the third, more slender; face pale yellowish. Mesonotum dark brown, the submedian lines pale yellowish. Scutellum, postscutellum and abdomen a nearly uniform fuscous yellowish, the latter sparsely haired, ovipositor dark brown. Wings hyaline, costa light brown. Halteres pale yellowish, fuscous subapically. Coxae, femora and tibiae mostly light fuscous yellowish, tarsi mostly dark brown; claws short, stout, slightly curved, the pulvilli shorter than the claws. Ovipositor as long as the body, with a long, slender, biarticulate lobe, the second segment with a length three times its diameter. Type Cecid. a1555y.

Winnertzia ampelophila Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 144 (separate, p. 48) (Porricondyla)

1908 ———— N. Y. State Mus. Bul. 124, p. 422

The midge was taken at Albany, N. Y., on Virginia creeper, Psedera quinquefolia, July 3, 1906. The wing is illustrated on plate 4, fig. 11.

Male. Length 1.5 mm. Antennae a little shorter than the body; sparsely haired, dark brown, fuscous yellowish basally; 14 segments, the fifth with a stem one-third the length of the cylindric basal enlargement, which latter has a length twice its diameter; the two

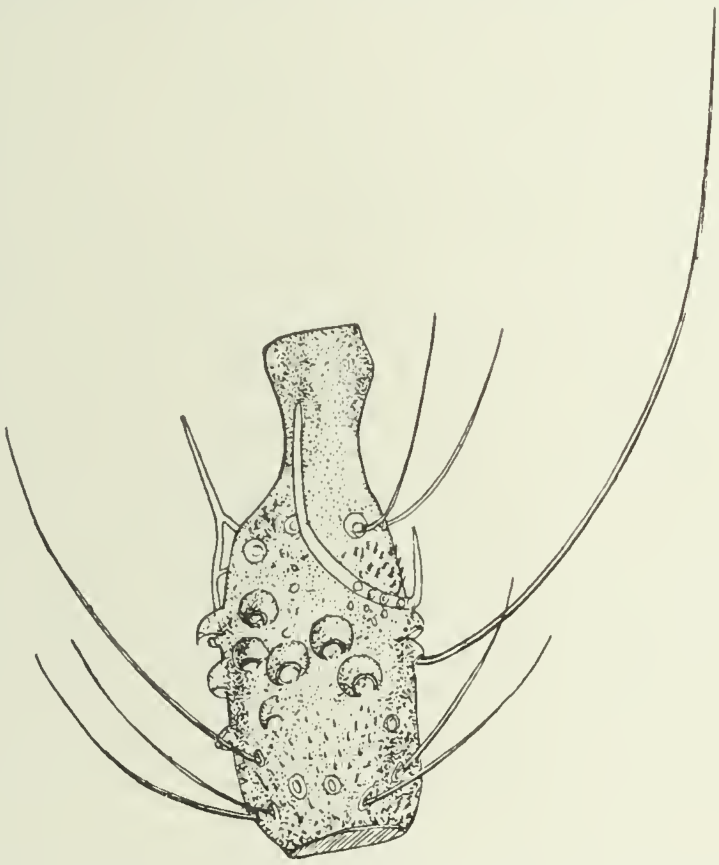


Fig. 3 Winnertzia ampelophila; sixth antennal segment of male, enlarged (original)

distal segments rather closely fused, both with the basal portion slightly produced and no distal stem. Palpi; the first segment short, subquadrate, the second more than twice its length, slightly dilated near the middle, the third a little longer, more slender, the fourth about twice the length of the third, more slender. Face fuscous yellowish. Mesonotum nearly uniform dark brown. Scutellum dark reddish brown, postscutellum dark brown. Abdomen dark yellowish brown with yellowish on the dorsum of the fourth segment, sparsely clothed with dark hairs. Wings subhyaline, costa dark brown. Halteres yellowish transparent. Legs pale fuscous yellowish, tarsi slightly darker; claws short, stout, slightly curved. Genitalia; basal clasp segment short, very broad, truncate; terminal clasp segment short, very stout, the internal distal angle with a long, stout, spine. Dorsal plate apparently very broad, slightly emarginate; ventral plate long, broad, deeply and narrowly emarginate, the lobes narrowly rounded; style long, slender. Type Cecid. 450.

Winnertzia solidaginis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 149 (separate, p. 53)
1908 ———— N. Y. State Mus. Bul. 124, p. 422

The male was taken in general collecting on goldenrod, solidago, and aster at Albany, N. Y., July 6, 1906.

Male. Length .75 mm. Antennae probably as long as the body, sparsely haired, dark brown; probably 14 segments, the fifth with a stem one-third the length of the cylindric basal enlargement, which latter has a length twice its diameter. Palpi; first segment short, subquadrate, the second subrectangular, with a length twice the first, the third one-half longer, stouter, the fourth nearly twice the length of the third, slender. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum fuscous brown, yellowish apically, postscutellum and abdomen dark brown. Wings hyaline, costa light brown. Halteres pale yellowish. Legs pale yellowish, the tarsi variably tinged with orange. Genitalia; basal clasp segment long, stout; terminal clasp segment stout, with a length thrice its diameter. (Plate 5, figure 4). Type Cecid. 508.

Winnertzia karnerensis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 422

This species was taken on hard pine, Pinus rigidae, at Karner, N. Y., June 26, 1906. The wing is figured on plate 4, fig. 10.

Female. Length 2 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown; 14 segments, the fifth with a length twice its diameter; the 13th and 14th partially fused, the latter slightly produced, subconic. Palpi; the first segment long, irregular, the second twice the length of the first, rectangular, the third a little longer, slender, the fourth longer and more slender than the third. Mesonotum dark brown with scattering, pale setae. Scutellum and postscutellum fuscous. Abdomen pale straw. Wings hyaline, costa dark brown. Halteres slightly fuscous. Legs with the coxae and femora brown; tibiae a little darker, tarsi gray; claws stout, slightly curved; the pulvilli shorter than the claws. Ovipositor probably nearly as long as the body, slender; terminal lobes slender, probably biarticulate, narrowly rounded. Type Cecid. 395.

Winnertzia aceris Felt

1913 **Felt, E. P.** N. Y. Ent. Soc. Jour. 21:213–14

The white larvae of this species occur singly or in small groups under the thin, decaying bark of sugar maple. The adults are closely allied to both W. calciequina Felt and W. pectinata Felt. The male of the former has heavy circumfili extending to the basal fourth of the enlargement, while in this species the basal portion of the circumfili reaches only to the distal third of the enlargement as in W. pectinata. The chitinization of these structures is much weaker than in the last named species, the basal enlargement is more globose and cylindric and there are differences in the genitalia. Detailed descriptions are given in the above citation.

Fig. 4 *Winnertzia calciequina*; lateral view of ninth antennal segment of male, enlarged (original)

Winnertzia calciequina Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 161
1908 ———— N. Y. State Mus. Bul. 124, p. 421

Described from insects taken on pine, probably Pinus strobus, at Albany, N. Y., July 24, 1906.

Male. Length 2 mm. Antennae a little shorter than the body, thickly haired, dark brown, yellowish basally; 14 segments, the fifth with a stem three-fourths the length of the subcylindric basal enlargement, which latter has a length twice its diameter; terminal segment somewhat reduced, narrowly rounded apically. Palpi; the first segment short, subquadrate, the second greatly produced, slightly swollen distally, perhaps composed of two fused, the third about one-half the length of the preceding, more slender than the distal portion, the fourth one-half longer than the third, slightly more dilated. Face greenish yellow. Mesonotum dark brown, sparsely clothed with fine, silvery hairs; scutellum and postscutellum dark brown. Abdomen yellowish green basally, the apical segments light brown. Wings hyaline, costa dark brown. Halteres whitish transparent. Coxae, femora and tibiae mostly pale yellowish, tarsi nearly uniform fuscous; claws stout and strongly curved; the pulvilli very short. Genitalia; basal clasp segment very stout, broad, obliquely truncate; terminal clasp segment short, stout, broadly rounded and with a conspicuous, slender spine. Dorsal plate long, broad, slightly emarginate. Ventral plate long, broad, broadly rounded; style rather long, stout, broadly rounded.

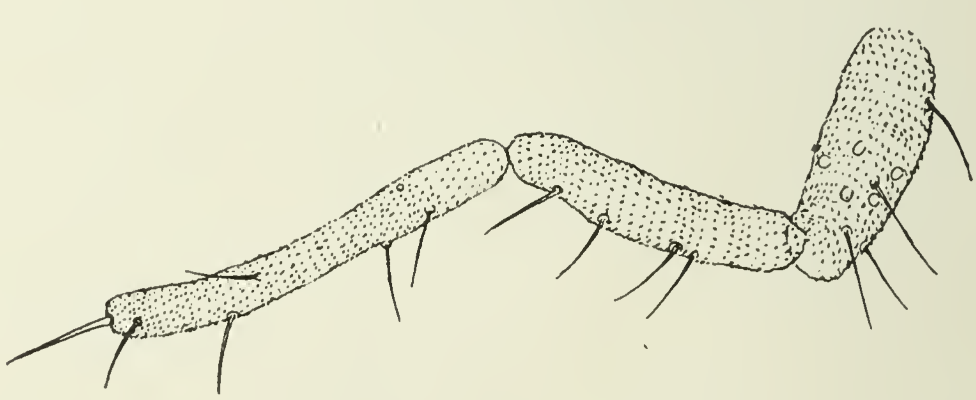


Fig. 5 Winnertzia calciequina; female palpus, enlarged (original)

Female. Length 2 mm. Antennae extending to the second abdominal segment, sparsely haired, dark brown; 14 segments, the

fifth subsessile, subcylindric, with the length two and one-half times greater than the diameter; (figure 2); terminal segment

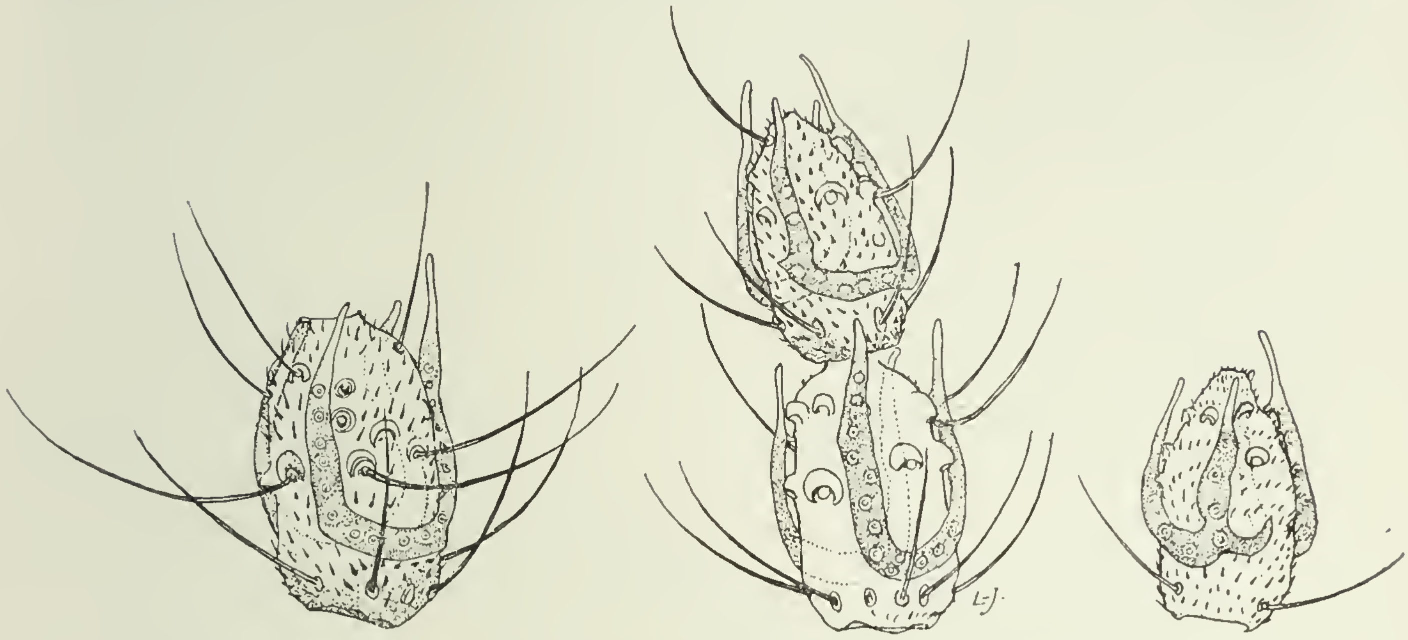


Fig. 6 Winnertzia calciequina, female; *a*, 11th antennal segment; *b*, distal two antennal segments of the right antenna; *c*, distal antennal segment; enlarged (original)

slightly reduced, narrowly rounded distally. Palpi; the first segment short, subquadrate, the second a little stouter, longer, the third one-half longer than the second, more slender, the fourth nearly twice as long as the third and more slender. Eyes large, black. Mesonotum olive brown, submedian lines indistinct. Scutellum

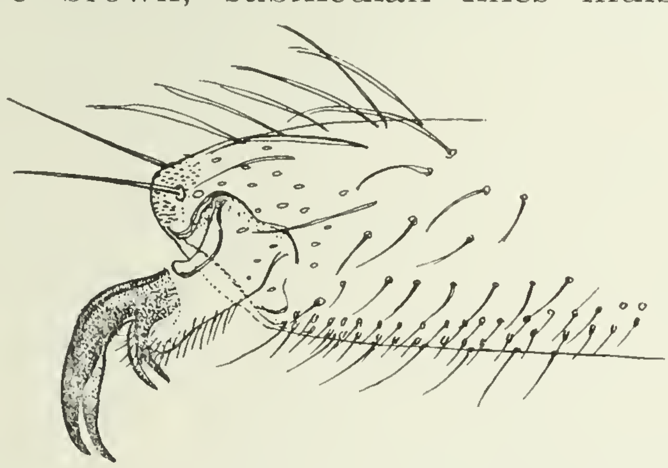


Fig. 7 Winnertzia calciequina; lateral view of claw and tip of last tarsal segment of female, enlarged (original)

fuscous greenish, postscutellum dark brown. Abdomen greenish yellowish, ovipositor dark brown, sparsely clothed with fine fuscous

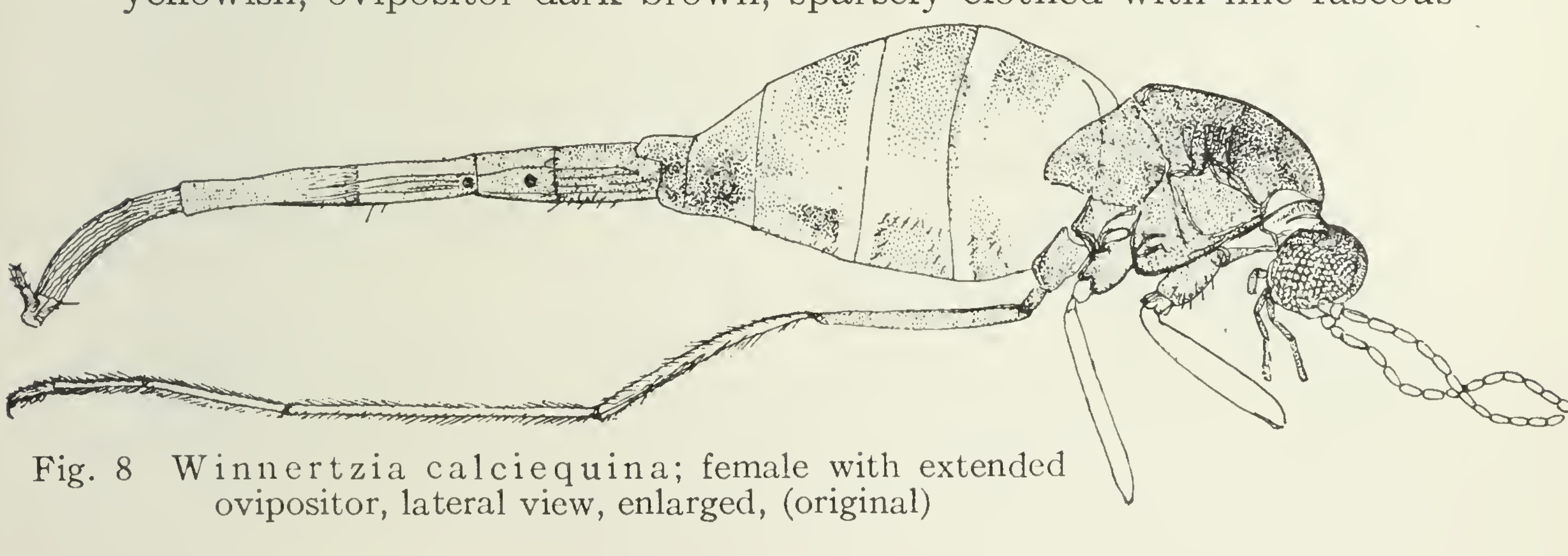


Fig. 8 Winnertzia calciequina; female with extended ovipositor, lateral view, enlarged, (original)

hairs. Wings narrow, subhyaline, costa dark brown. Halteres slightly fuscous basally, white apically. Legs mostly a light fuscous yellowish distally, tarsal segments dark brown; claws stout, strongly curved; pulvilli very short. Ovipositor nearly as long as the body, stout, the terminal lobes biarticulate, the terminal segment long, broad, subquadrate. (figure 9). Type Cecid. 561.

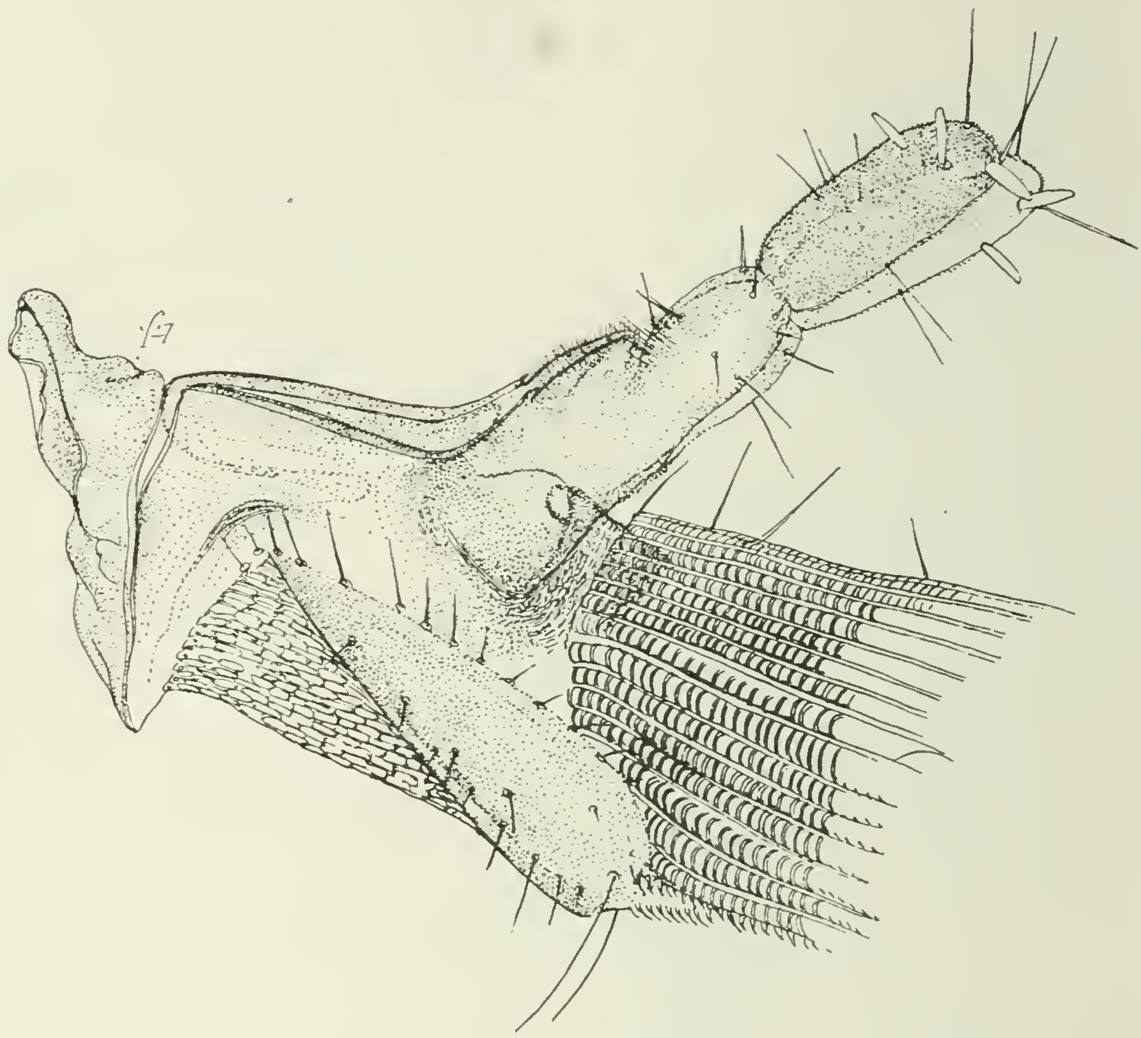


Fig. 9 W i n n e r t z i a c a l c i e q u i n a; tip of female ovipositor, enlarged (original)

Winnertzia pectinata Felt

1911 **Felt, E. P.** Econ. Ent. Jour. 4:478

Larvae of this species were found November 24, 1910 in partly decayed chestnut bark at Nassau, N. Y. There were also many similar appearing, though very different larvae, Medeterus, which apparently preyed upon these midge larvae and became relatively more abundant in the spring. Adult midges were reared from April 26th to the last of May or in early June. The insect is evidently allied to W. c a l c i e q u i n a Felt, from which it is most easily separated by the stouter antennal segments, color differences and the longer, stouter terminal clasp segment. Larvae collected in the field April 11th remained alive and under constant observation till May 15th, the fly being found June 5th. The larvae show no sign of a breastbone in the fall and early spring.

Larva. Length 4 mm; white. Head long, tapering, narrowly rounded apically. Antennae stout, with a length fully three times the diameter. Body moderately stout, the skin finely ridged longitudinally, the posterior extremity distinctly bilobed, each lobe with a conical, chitinous process apically. Shortly before transformation a distinct, lance-shaped, dark brown breastbone may be observed. The ocular spot is largely obscured by adjacent tissue.

For a description of the male, see the citation above.

Female. Length 1.5 mm. Antennae extending to the base of the abdomen, thickly haired, fuscous yellowish; 13 subsessile segments, the fifth subcylindric, with a length two and one-half times its diameter, a sparse subbasal whorl of short setae and a scattering subapical band of long, slender setae, terminal segment produced, with a length fully three times its diameter and tapering slightly to a narrowly rounded apex. Face fuscous yellowish. Palpi lighter, the first segment subquadrate, with a length nearly three times its diameter, the second stouter, one-half longer, the third a little longer than the second, more dilated, the fourth one-half longer than the third. Mesonotum fuscous yellowish, the submedian lines sparsely haired. Scutellum fuscous yellowish, postscutellum a little lighter. Abdomen fuscous yellowish, the stout ovipositor mostly fuscous, yellowish apically. Halteres fuscous yellowish, fuscous subapically. Coxae fuscous yellowish; femora basally a whitish transparent, the distal portion of femora, tibiae and tarsi a light fuscous straw; claws stout; the pulvilli rudimentary. Ovipositor with a length greater than the body; terminal lobes irregular, with a length about three times the greatest width, indistinctly triarticulate. Type Cecid. a2109.

Winnertzia rubida Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 422

The male was swept from syringa at Albany, N. Y., June 15, 1906.

Male. Length 1.25 mm. Antennae as long as the body, thickly haired, yellowish brown; 14 segments, the fifth with a stem three-fourths the length of the cylindric basal enlargement, which latter has a length one-half greater than its diameter; terminal segment reduced, conic, with a length three times its diameter. Palpi; first segment cylindric, with a length three times its diameter, the second a little longer, stouter, the third one-half longer, more slender and the fourth a little longer and more slender. Mesonotum dull black, the submedian lines sparsely haired. Scutellum fuscous, yellowish apically, postscutellum and abdomen dull brown, the latter sparsely clothed with fuscous hairs. Wings hyaline, costa fuscous yellowish. Halteres yellowish fuscous. Legs a nearly uniform yellowish; claws stout, strongly curved; the pulvilli rudimentary. Genitalia; basal clasp segment stout; terminal clasp segment stout, dorsal plate broad, broadly and roundly emarginate, ventral plate short, broad deeply emarginate. Type Cecid. 300.

Winnertzia pinicorticis Felt

1907 **Felt, E. P.** New Species of Cecidomyiidae II, p. 23
1908 ——— N. Y. State Mus. Bul. 124, p. 304, 422
1909 ——— Ent. Soc. Ont. 39th Rep't, p. 46

This species was reared by Mr Pergande from under the bark of Pinus virginiana February 5 and 16, 1892 and taken by Mr Farley at Strom, Va.

Male. Length 1 mm. Antennae as long as the body, thickly haired, fuscous yellowish; 14 segments, the fifth with a stem as long as the subcylindric basal enlargement, which latter has a length fully one-half greater than its diameter; terminal segment produced, broadly rounded apically. Palpi; the first segment with a length more than twice its diameter, slightly expanded apically, the second as long as the first, much stouter, the third one-third longer than the second, more slender, the fourth nearly twice the length of the third and more slender. Mesonotum dark brown, scatteringly clothed with yellowish setae, the submedian lines indistinct. Scutellum reddish brown, postscutellum a little darker, abdomen dark brown. Wings hyaline, costa light brown. Halteres pale yellowish. Legs a nearly uniform fuscous yellowish. Genitalia; basal clasp segment short, stout, obliquely truncate; terminal clasp segment short, stout, greatly swollen, apically with two long, slender spines and minor teeth; dorsal plate broad, long, slightly emarginate, the lobes broadly rounded; ventral plate short, broad, deeply and narrowly emarginate. Type Cecid. 1047.

DIDACTYLOMYIA Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:39
1913 **Kieffer, J. J.** Gen. Insect, fasc. 152, p. 263

This remarkable genus is easily separated from Colpodia to which it was provisionally referred, by the slightly broader wings, the fifth vein not being close to the posterior margin, and especially by the peculiar genitalia, both the basal and terminal clasp segments being greatly produced, the latter with a length fully seven times its diameter. The claws are unidentate. Females provisionally referred to this genus have 14 subsessile cylindric antennal segments and a short ovipositor, the lobes biarticulate. Type Colpodia longimana Felt.

Didactylomyia longimana Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 416 (Colpodia)
1914 N. Y. Ent. Soc. Jour. 22:127

Described from a striking male taken at Auburndale, Mass., August 16, 1906 by Prof. C. W. Johnson. Both sexes were collected by C. P. Alexander in August 1909 at Woodworth's lake at an altitude of about 1500 feet. The female has been described, see the second citation.

Male. Length 1.5 mm. Antennae longer than the body, sparsely haired, light brown, yellowish basally, 15 segments, the fifth with a stem, slightly enlarged distally, fully one-fourth longer than the cylindric basal enlargement, which latter has a sparse subbasal

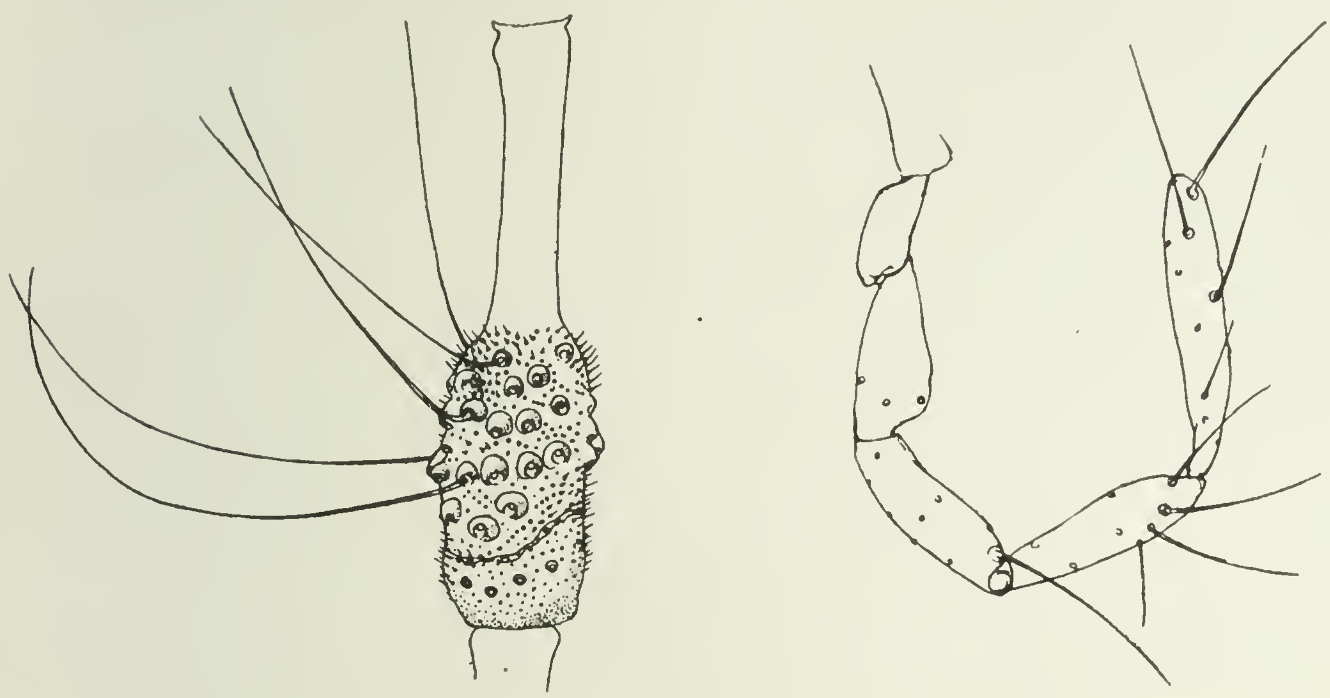


Fig. 10 Didactylomyia longimana, male; *a*, 5th antennal segment, the obscure distal circumfilum not being represented in the illustration; *b*, male palpus, enlarged, (original)

whorl of short, stout, slightly curved setae, a broad subapical band of long, slender, curved setae. Irregular, slightly elevated circumfili occur near the basal third and apically. Mouth parts produced, with a length about one-half the transverse diameter of the head. Palpi; the first segment long, the second one-fourth longer than the first, more slender, the third as long as the second, fusiform, the fourth one-fourth longer than the third, more slender. Face yellowish. Mesonotum pale yellowish orange, the submedian lines yellowish, indistinct. Scutellum whitish, postscutellum pale orange. Abdomen pale yellowish orange. Genitalia pale orange. Wings hyaline, costa pale brown. Halteres yellowish basally, whitish apically. Legs a variable fuscous yellowish, the tarsi light brown; claws long, slender, strongly curved, a long, slender, curved tooth basally, the pulvilli nearly as long as the claws. Genitalia; basal clasp segment slender, a small, triangular lobe at the internal basal angle; terminal clasp segment very slender, strongly curved near the basal fourth; dorsal plate short, broad, deeply and triangularly incised, the lobes irregularly rounded; ventral plate broad, broadly and roundly emarginate, the lobes short, well separated; style short, stout, tapering, obtusely rounded. Plate 5, figure 5. Type Cecid. 830.

Fig. 11 Didactylomyia longimana. Lateral view of claw and tip of last tarsal segment, enlarged, (original)

Didactylomyia maculata n. sp.

This pale orange species was taken in a trap lantern at Poughkeepsie, N. Y., June 28, 1906. The same species or a closely allied form was also taken in a trap lantern at Newport, N. Y., July 11, 1906.

Female. Length 1 mm. Antennae about two-thirds the length of the body, sparsely haired, slaty brown, yellowish basally; 14 segments, the fifth with a stem one-fourth the length of the cylindric basal enlargement, which latter has a length thrice its diameter; terminal segment produced, with a length fully four times its diameter and a long, slender, slightly capitate process apically. Palpi; first segment rectangular, with a length four times its diameter, the second a little longer than the first, the third about as long as the second, the fourth one-half longer than the third. Face orange yellow, the mouth parts produced, with a length fully half the width of the head. Mesonotum a light orange yellow. Scutellum pale yellowish, postscutellum and abdomen pale orange yellowish, slightly darker basally and apically. Wings whitish, subhyaline, slightly fuscous at the apical fourth, there being an oval spot just behind costa and another on the third vein; costa yellowish, the crossvein joining subcosta near its basal half, the latter uniting with costa at the basal third, the third vein well beyond the apex. Halteres pale yellowish. Coxae pale yellowish, the anterior and mid legs a nearly

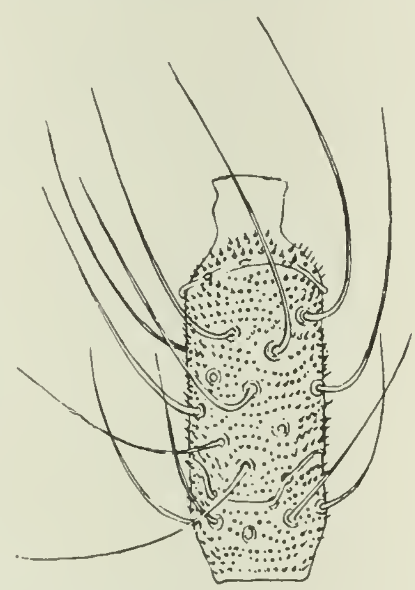


Fig. 12 Didactylomyia maculata. Fifth antennal segment of female, enlarged

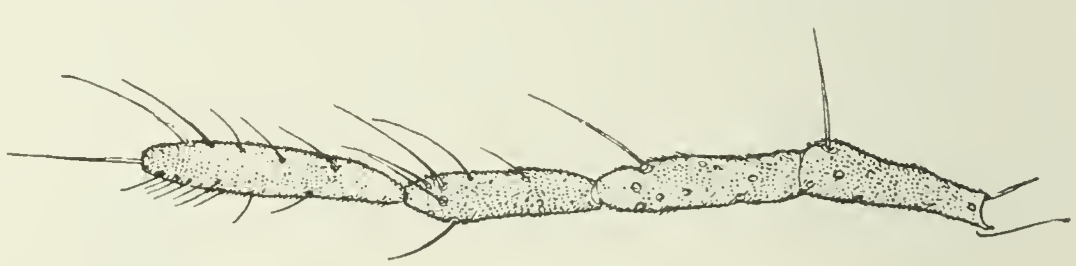


Fig. 13 Didactylomyia maculata. Female palpus, enlarged, (original)

uniform brownish black, the posterior legs with the tibiae and tarsi pale yellowish, annulate with fuscous distally; tarsi brownish black; claws slender, evenly curved; the pulvilli nearly as long as the claws. Ovipositor short, the lobes biarticulate, the distal segment narrowly oval. Type Cecid. 415.

Didactylomyia capitata Felt

1913 **Felt, E. P.** Psyche, 20:174

The peculiar male was taken by Mr Owen Bryant in August 1907, either at North Adams, Mass., or on Greylock mountain. It is closely allied to D. longimana Felt.

Didactylomyia flava n. sp.

The yellowish midge was taken on dogwood, Cornus, at Albany, N. Y., July 6, 1906.

Female. Length 1.66 mm. Antennae about two-thirds the length of the body, sparsely haired, dark brown, yellowish basally; 14 segments, the fifth with a stem about one-fifth the length of the cylindric basal enlargement, which latter has a length fully three times its diameter. Palpi; the first and second segments probably short, rectangular, the third with a length three times its diameter, the fourth only a little longer than the third, equally stout. The produced face pale yellowish. Thorax and abdomen a nearly uniform bright yellowish, except for a dark, oval spot at the base of the latter. Costa light yellowish, the slender though distinct crossvein at the distal third of subcosta, which latter joins costa at the basal third, the third vein uniting with the margin well beyond the apex. Coxae pale yellowish, the posterior femora and tibiae yellowish straw, the tarsi and other legs mostly dark fuscous; claws slender, evenly curved; the pulvilli nearly as long as the claws. Ovipositor short, the terminal lobes biarticulate, the terminal segment narrowly and irregularly oval, minor lobes short, stout, setose. Type Cecid. 520.

LIEBELIOLA Kieff. & Jörg.

1910 **Kieffer, J. J.** and **Jörgensen, P.** Centrbl. Bakt, Parsit. Insektk. 27:428-29

This Argentine genus is provisionally referred to the Porricondylariae, it being easily separated from Didactylomyia Felt by the presence of a supernumerary vein at the base of subcosta, and the simple claws. Antennae of the female with 14 segments, the third fused with the fourth, the fifth subcylindric, with a length three times its diameter, scarcely constricted and with a stem twice as long as thick. Palpi quadriarticulate. Mouth parts one-third as long as the head. Supernumerary vein extends to the middle of subcosta, which latter unites with costa near the middle of the wing and is joined to the third vein by a very oblique crossvein; the fifth vein joins the posterior margin near the distal third, its very short branch a little before the basal half. The simple fuscous claws are twice as long as the pulvilli. Ovipositor slightly produced, the lamellae short, elliptical and thickly haired. This insect winters in a subglobose, stem gall on Prosopis strombulifera. Type L. prosopidis Kieff & Jörg.

COLPODIA Winn.

1853 **Winnertz, J. W.** Linn. Ent., 8:293-94
1862 **Osten Sacken, C. R.** Dipt. N. Am., 1:176
1863 **Schiner, J. R.** Fauna Austriaca Dipt., 2:401
1876 **Bergenstamm, J. E. & Low, Paul,** Syn. Cecidomyidarum, p. 23
1877 **Karsch, F. A. F.** Revis. de Gallmucken, p. 16

1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:39, 43, 114
1896 **Kieffer, J. J.** Berln. Ent. Zeit., 41:10
1897 ———— Syn. Cecid. de Eur. & Alg., p. 43
1900 ———— Soc. Ent. Fr. Ann., 69:447
1904 **Meunier, F.** Soc. Sci. Brux. Ann., 28:8
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 415
1911 ———— N. Y. Ent. Soc. Jour. 19:40
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 268

This genus is distinguished from all other Porricondylids by the extremely long, narrow wings (plate 4, figures 1, 2), the third vein being united to subcosta by a very oblique crossvein and joining the margin well beyond the apex. The female has 12 or 13, and in one case, 16 antennal segments, the fifth with a short stem about one-fourth the length of the basal enlargement. The male has 16 antennal segments, the fifth with a stem ranging from one-third the length of the basal part to more than twice its length. The palpi are quadriarticulate. The ovipositor is short, biarticulate. The male genitalia are moderate, usually with a short, greatly swollen terminal clasp segment (plate 5, figures 1, 2, 3). The type of this genus, C. angustipennis Winn., is in an excellent state of preservation at the University of Bonn and is easily recognized by the very narrow wings. But little is known concerning the life history of these forms.

Key to species

a 12 antennal segments, females
  b Abdomen reddish brown, length 1 mm; wings very narrow, with a length about five times the width .... graminis Felt, C. 570
  bb Abdomen reddish yellow, length 2 mm; wings rather broad, with a length about four times the width .... temeritatis Felt, C. a1546b
  bbb Abdomen pale yellowish, length 3 mm; wings broad, with a length about three times the width .... sylvestris Felt, C. 1477
aa 13 antennal segments, females
  b Fifth antennal segment with a stem one-quarter the length of the basal enlargement
    c Abdomen carmine, length 1.5 mm, the basal enlargement of the fifth antennal segment with a length six times its diameter, the fourth palpal segment with a length four times its diameter .... sanguinia Felt, C. 1227
    cc Abdomen yellowish brown, length 1.6 mm, the basal enlargement of the fifth antennal segment and the fourth palpal segment with a length five times their diameters, respectively .... terrena Felt, C. 525
    ccc Abdomen yellowish orange, length 3 mm, the basal enlargement of the fifth antennal segment with a length five times its diameter, the fourth palpal segment with a length seven times its diameter .... alta Felt, C. 481

cccc Abdomen yellowish brown, length 1 mm, the basal enlargement of the fifth antennal segment with a length four times its diameter, the fourth palpal segment with a length five times its diameter. Reared from Poa pratensis..............pratensis Felt, C. 256

bb Fifth antennal segment with a stem as long as the basal enlargement

c Abdomen brownish yellow, length 2.75 mm....porrecta Felt, C. 1484

aaa 16 antennal segments

b Fifth antennal segment with a stem one-third the length of the basal enlargement, female

c Abdomen pale orange, length 2 mm, the basal enlargement of the fifth antennal segment with a length three times its diameter..............
maculata Felt, C. 560

bb Fifth antennal segment with a stem one-half longer than the basal enlargement, male

c Abdomen pale salmon, length 2 mm, the basal enlargement of the fifth antennal segment subglobose..................pinea Felt, C. a1622

cc Abdomen reddish brown, length 1.5 mm, the basal enlargement of the fifth antennal segment with a length one-half greater than its diameter
cornuta n. sp., C. a2097

bbb Fifth antennal segment with a stem twice the length of the basal enlargement, male

c Abdomen dark brown, length .75 mm, the basal enlargement of the fifth antennal segment with a length twice its diameter ....
trifolii Felt, C. 455

cc Abdomen fuscous yellowish, length 1.2 mm, the basal enlargement of the fifth antennal segment with a length one-half greater than its diameter.............................americana Felt, C. 1478

bbbb Fifth antennal segment with a stem two and one-half times the length of the basal enlargement, male

c Abdomen pale yellowish, length 1 mm, the basal enlargement of the fifth antennal segment with a length three times its diameter..............
diervillae Felt, C. 485

cc Abdomen pale yellowish, length 1.75 mm, the basal enlargement of the fifth antennal segment with a length twice its diameter..............
pectinata Felt, C. a1599

ccc Abdomen fuscous yellowish, length 1.3 mm, the basal enlargement of the fifth antennal segment with a length twice its diameter..........
carolinae Felt, C. a1624

cccc Abdomen light brownish yellow, length 1 mm, the basal enlargement of the fifth antennal segment with a length two and one-fourth times its diameter..........................capitata Felt, C. 1480

ccccc Abdomen dark yellowish brown, length 1.75 mm, the basal enlargement of the fifth antennal segment with a length twice its diameter......
ovata Felt, C. 1496

Colpodia graminis Felt

1907 **Felt, E. P.** N. Y. State Bul. 110, p. 146 (separate, p. 50) (Porricondyla)
1908 ———— N. Y. State Mus. Bul. 124, p. 416

This female was taken on quack grass, Agropyron repens, at Albany, N. Y., July 14, 1906.

Female. Length 1 mm. Antennae about as long as the body, sparsely haired, dark brown; 12 segments, the fourth with a short stem one-fourth the length of the subcylindric basal portion; terminal segment prolonged, subcylindric, one-half longer than the preceding. Palpi; the first segment short, subquadrate, the second rather long, slender basally, swollen distally, the third two-thirds the length of the second, stout, narrowly oval, the fourth a little shorter and more slender than the third, the fifth one-half longer than the fourth, broad, flattened. Mesonotum dark brown. Scutellum deep carmine, postscutellum reddish. Abdomen reddish brown, lighter distally. Legs a nearly uniform pale brown; claws stout, strongly curved, slightly swollen at the distal fourth, simple. Ovipositor short, lobes biarticulate, basal portion subquadrate, distal part suborbicular. Type Cecid. 570.

Colpodia temeritatis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 416

Described from a female reared September 9, 1907 apparently from ash, Fraxinus, leaves bearing a purplish green, subglobular gall some 5mm in diameter, taken near Albany. This gall appears to be the one Osten Sacken originally described under the name of C. pellex. It is very doubtful if this insect is the true cause of the deformity.

Female. Length 2 mm. Antennae one-half the length of the body, sparsely haired, reddish brown, yellowish basally; 12 segments, the fifth with a stem one-half the length of the somewhat stout basal enlargement, which latter has a length three times its diameter, terminal segment greatly produced, with a length six times its diameter and evidently composed of two closely fused segments. Palpi; first segment rather stout, rectangular, the second one-half longer than the first, the third a little longer and more slender than the second, the fourth one-half longer and more slender than the third. Face yellowish. Mesonotum brownish yellow, the broad submedian lines yellowish. Scutellum brownish red, postscutellum pale yellowish. Abdomen pale reddish yellow. Wings rather broad, hyaline, costa fuscous yellowish. Halteres pale orange, yellowish basally. Coxae pale yellowish; femora, tibiae and tarsi light fuscous yellowish; claws strongly curved, simple, the pulvilli longer than the claws. Ovipositor short, terminal lobe narrowly oval. Type Cecid. a1546b.

Colpodia sylvestris Felt

1914 **Felt, E. P.** N. Y. Ent. Soc. Jour. 22:126

This midge, allied to C. temeritatis Felt, was taken in August 1909 by Mr C. P. Alexander at Woodworth's lake in the Adirondacks at an altitude of 1550 feet. A detailed description is given in the citation above.

Colpodia sanguinia Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 416

This species was taken on a window at Nassau, N. Y., July 15, 1907. Midges have been reared recently by Dr J. M. Aldrich from an almost pure blue grass sod.

Female. Length 1.5 mm. Antennae nearly as long as the body, sparsely haired, brown; 13 segments, the fifth with a stem one-fourth the length of the cylindric basal enlargement, which latter has a length six times its diameter; terminal segment slightly produced, narrowly fused with the preceding and broadly rounded apically. Palpi; first segment long, incrassate, the second stout, with a length three times its diameter, the third a little longer, more dilated, the fourth a little longer than the third, with a length four times its diameter. Mesonotum light brown, yellowish posteriorly. Scutellum yellowish and carmine, postscutellum yellowish. Abdomen a variable carmine, the basal segments clouded with fuscous, the distal ones pale yellowish. Wings hyaline, costa light straw. Halteres yellowish basally, carmine apically. Legs a nearly uniform yellowish straw, the articulations variably tinged with dark carmine, the distal tarsal segments reddish or reddish brown; claws stout, strongly curved, slightly swollen subapically, simple, the pulvilli a little shorter than the claws. Ovipositor short, the distal segment broadly oval. Type Cecid. 1227.

Male. Length 1.5 mm. Antennae more than twice the length of the body, sparsely haired, yellowish brown; 16 segments, the fifth with a stem two and one-half times the length of the basal enlargement, which latter has a length about twice its diameter. Palpi; first segment slender, with a length fully four times its diameter, the second dilated, with a length less than three times its diameter, the third a little longer and more slender than the second, the fourth one-fourth longer than the third. Mesonotum yellowish brown, the submedian lines yellowish. Scutellum and postscutellum pale yellowish. Abdomen yellowish orange, the genitalia fuscous. Halteres yellowish basally, fuscous apically. Coxae yellowish. Legs a nearly uniform fuscous yellowish; claws slender, strongly curved, the pulvilli a little shorter than the claws. Genitalia; basal clasp segment short, stout; terminal clasp segment short, smooth, narrowly oval; dorsal plate short, deeply and roundly emarginate, the lobes narrowly rounded; ventral plate long, divided, the lobes roundly truncate. Harpes stout, heavily chitinized and with a heavy subapical spur. Cecid. a2636.

The structure of the male genitalia indicates a close relationship to C. trifolii Felt from which this species may be separated by the lighter color, the longer stems of the flagellate antennal segments and the distinctly shorter terminal clasp segment.

Colpodia terrena Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 416

The female was taken on quack grass, Agropyron repens, at Albany, N. Y., July 7, 1906.

Female. Length 1.35 mm. Antennae a little shorter than the body, sparsely haired, light brown, yellowish basally; 13 segments, the fifth with a stem about one-fourth the length of the cylindric basal enlargement, which latter has a length five times its diameter; terminal segment somewhat produced and narrowly fused with the

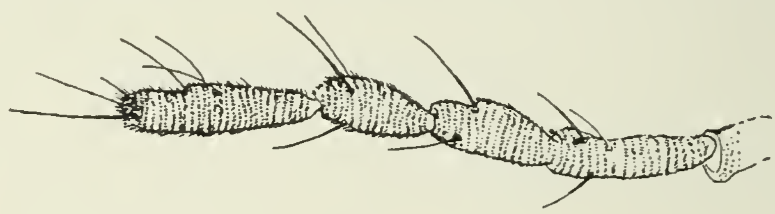


Fig. 14 Colpodia terrena; palpus, enlarged (original)

preceding. Palpi; first segment long, slender, the second with a length three times its diameter, the third subequal, the fourth one-half longer than the third. Face yellowish. Mesonotum slaty brown with a broad, median, sooty yellow stripe continued laterally and expanded posteriorly. Scutellum and postscutellum dull reddish. Abdomen a yellowish brown, sparsely clothed with fine hairs. Wings hyaline, costa light brown. Halteres pale yellowish basally, fuscous reddish apically. Legs a nearly uniform fuscous straw, tarsi slightly darker;

Fig. 15 Colpodia terrena; lateral view of apex of the abdomen and ovipositor, enlarged (original)

claws stout, strongly curved, distinctly enlarged subapically, the pulvilli shorter than the claws. Ovipositor short, terminal lobe broad, broadly rounded. Type Cecid. 525.

Colpodia alta Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 416

Described from a female taken on hard pine, Pinus rigida, at Karner, N. Y., July 5, 1906.

Female. Length 3 mm. Antennae extending to the fourth abdominal segment, sparsely haired, dark brown, yellowish basally; 13 segments, the fifth with a stem one-fourth the length of the cylindric basal enlargement, which latter has a length five times its diameter; terminal segment very narrowly fused with the preceding, slightly produced and narrowly rounded apically. Palpi; first segment with a length five times its diameter, the second two-thirds as long, the third about as long as the second, the fourth one-half longer than the third, with a length seven times its diameter. Mesonotum fuscous yellowish, the submedian lines indistinct. Scutellum and postscutellum fuscous yellowish. Abdomen a nearly uniform yellowish orange. Wings hyaline, costa light brown. Halteres yellowish basally, fuscous apically. Legs a pale straw; claws slender, strongly curved, simple, the pulvilli a little shorter than the claws. Ovipositor short, biarticulate, the terminal segment broadly oval. Type Cecid. 481.

Colpodia maculata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 416

This pale orange female was taken on pine, Pinus strobus, at Albany, N. Y., July 16, 1906.

Female. Length 2 mm. Antennae extending to the fourth abdominal segment, sparsely haired, dark brown, yellowish basally; 16 segments, the fifth with a stem one-third the length of the cylindric basal enlargement, which latter has a length three times its diameter; terminal segment somewhat produced, tapering to a narrowly rounded apex. Palpi presumably quadriarticulate. Face pale orange. Mesonotum bright orange, broadly margined laterally with fuscous. Scutellum pale orange, with indistinct reddish markings laterally, postscutellum pale yellowish. Abdomen pale orange, rather sparsely clothed with fine setae, each segment broadly and rather distinctly marked with fuscous, the color being deeper distally and somewhat paler basally; terminal segment nearly black, incisures and pleurae pale yellowish. Wings hyaline, slightly fuscous, costa dark brown. Halteres ferruginous. Coxae pale orange, femora, tibiae and basal tarsal segments ferruginous, the three distal tarsal segments silvery white; claws slender, strongly curved, simple, the pulvilli rudimentary. Ovipositor short, biarticulate, the distal segment narrowly oval. Type Cecid. 560.

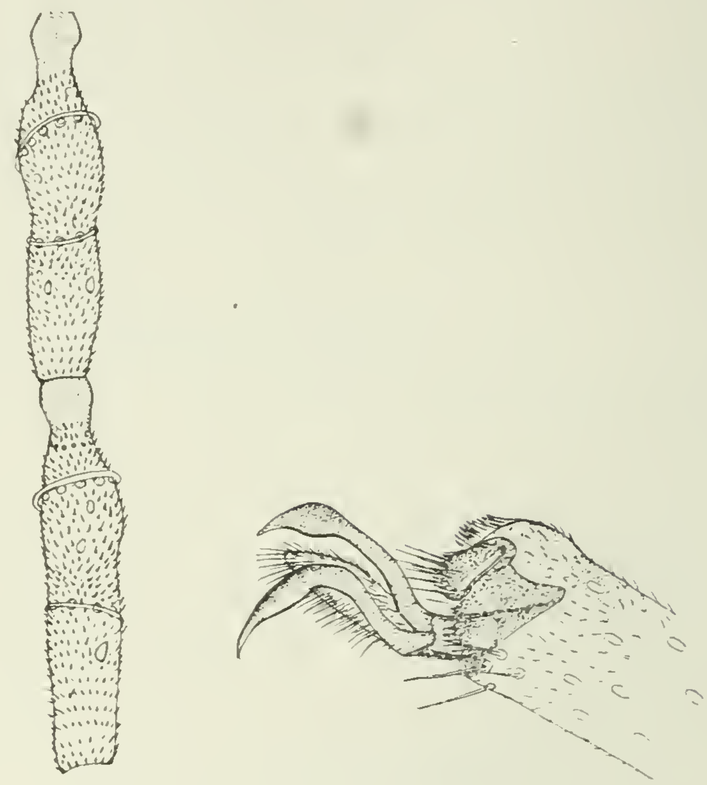
Colpodia pratensis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 416

The species was first taken on huckleberry, Gaylussacia baccata, and apparently reared from June grass, Poa

pratensis, July 8 and 28, 1886 by the then Division of Entomology at Washington.

Female. Length 1.25 mm. Antennae as long as the body, apparently naked, dark brown; 13 segments, the fifth subsessile, with



a *b*

Fig. 16 Colpodia pratensis, female; *a*, fifth and sixth antennal segments; *b*, lateral view of claw and tip of the last tarsal segment, enlarged (original)

a length six times its diameter; terminal segment reduced. Palpi; the first segment long, subrectangular, the second about one-half the length of the first, the third a little longer than the second and the fourth one-half longer than the third; face yellowish fuscous. Mesonotum dark reddish brown, the posterior median area reddish, submedian lines pale reddish, sparsely ornamented with fine setae. Scutellum dark reddish with sparse apical setae, postscutellum a little darker. Abdomen a nearly uniform dull brown, rather thickly clothed with very fine, yellowish hairs. Costa light brown, halteres yellowish transparent. Legs pale brown; claws stout, strongly curved, simple, with a subapical, fusiform swelling. Ovipositor short, terminal lobes suboval. Type Cecid. 256.

Colpodia porrecta Felt

1914 **Felt, E. P.** N. Y. Ent. Soc. Jour. 22:126

The females are easily distinguished by the unusually long stems of the flagellate antennal segments. They were collected August 21, 1909 by Mr C. P. Alexander at Woodworth's lake in the Adirondacks, altitude 1570 feet. A detailed description is given in the citation above.

Colpodia pinea Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 145 (separate, p. 48) (Porricondyla)

1908 ———— N. Y. State Mus. Bul. 124, p. 416

This male was taken at Davidson's River, N. C., September 24, 1906 on a pine, the heartwood of which was infested by M o n a r d i a l i g n i v o r a.

Male. Length 2 mm. Antennae longer than the body, sparsely haired, yellowish brown, yellowish basally; 16 segments, the fifth with a stem one-half longer than the subglobular enlargement. Palpi; the first segment slender, elongate, second and third a little longer and stouter, and the fourth slender and one-fourth longer than the preceding two. Mesonotum light brown, yellowish posteriorly, submedian lines broad, yellowish. Scutellum light reddish, postscutellum yellowish. Abdomen pale salmon, the color slightly deeper on the basal and antepenultimate segments; genitalia fuscous yellowish. Wings hyaline, costa light brown. Halteres yellowish basally, light fuscous apically. Coxae pale salmon, legs a nearly uniform light fuscous yellowish, all the tarsi missing; claws probably simple. Genitalia; basal clasp segment stout, produced internally and with a conspicuous curved submedian tooth extending posteriorly almost as far as the terminal clasp segment; the latter stout, broadly rounded apically and with a subapical comb. Dorsal plate broad, narrowly emarginate, the lobes broadly rounded, obliquely truncate, setose; ventral plate apparently composed of two narrow, widely separated setose lobes. Harpes heavy, converging, fused distally; style short, stout, narrowly rounded. (Plate 5, figure 2.) Type Cecid. a1622.

Colpodia cornuta n. sp.

The male described below was reared April 27, 1911 from a large collection of oak spangle galls, probably those of N e u r o t e r u s u m b i l i c a t u s in which was a small amount of debris. This material was collected October 31, 1910 by Miss Cora H. Clarke at the Arnold arboretum, Jamaica Plain, Mass.

Male. Length 1.5 mm. Antennae one-fourth longer than the body, sparsely haired, dark brown, the stems semitransparent; 16 segments, the fifth with a stem one-half longer than the subcylindric basal enlargement, which latter has a length about twice its diameter; terminal segment reduced, narrowly oval. Palpi; first segment subquadrate, the second narrowly oval, the third with a length about twice its diameter, the fourth probably one-half longer than the third. Mesonotum shining dark brown, the submedian lines sparsely haired. Scutellum fuscous yellowish, sparsely setose, postscutellum yellowish brown. Abdomen reddish brown; genitalia fuscous. Wings hyaline, costa dark brown. Halteres

pale fuscous yellowish, reddish apically. Coxae, femora and tibiae a pale fuscous yellowish, the tarsi slightly darker; claws rather long, swollen subapically, simple; the pulvilli about two-thirds the length of the claws. Genitalia; basal clasp segment short, stout; terminal clasp segment short, swollen and with a conspicuous, probably bidentate spine; dorsal plate long, broad, deeply and narrowly incised, the lobes broad, roundly truncate; ventral plate long, broad, broadly and triangularly emarginate, the lobes rather short and broadly rounded. Harpes stout, each with two heavy, recurved spines apically; style short, stout. Type Cecid. a2097.

Colpodia trifolii Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110:145 (separate, p. 49) (Porricondyla)
1908 ———— N. Y. State Mus. Bul. 124, p. 445

Described from a male taken on white clover, T r i f o l i u m r e p e n s , at Albany, N. Y., July 3, 1906.

Male. Length .75 mm. Antennae almost three times as long as the body, sparsely haired, dark brown; 16 segments, the fifth with a stem twice the length of the subcylindric basal enlargement, the latter with a length over twice its diameter. Palpi; the first segment long, slightly dilated apically, the second short, rather broadly oval, the third about as long, more slender, the fourth a little longer than the third. Mesonotum dark brown, submedian lines indistinct. Scutellum pale orange, postscutellum and abdomen dark brown. Genitalia slightly fuscous, sparsely clothed with yellowish hairs. Wings hyaline (Plate 4, figure 1), costa dark brown. Halteres pale yellowish. Legs nearly uniform dark brown; claws simple, uniformly curved, with a swelling subapically. Genitalia; basal clasp segment stout, internally with a narrowly rounded lobe at the distal third; terminal clasp segment greatly swollen basally, tapering to a narrow, recurved apex. Dorsal plate broad, deeply incised, the lobes well separated, broadly rounded, minor lobes rather broad, broadly and triangularly emarginate. Harpes stout, irregular, with a falciform, recurved spine and a broadly rounded, finger like process distally; style long, slender, strongly curved at the distal fourth. Type Cecid. 455.

Colpodia americana Felt

1914 **Felt, E. P.** N. Y. Ent. Soc. Jour. 22:124

The male described in detail in the citation above was taken by Mr C. P. Alexander August 14, 1909 on the east shore of Woodworth's lake in the Adirondacks, altitude 1550 feet.

Colpodia diervillae Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 145–46 (separate, p. 49) (Porricondyla)

1908 ———— N. Y. State Mus. Bul. 124, p. 417

This midge was taken on bush honeysuckle, Diervilla lonicera, at Karner, N. Y., July 5, 1906.

Male. Length 1 mm. Antennae one-half longer than the body, sparsely haired, dark brown, yellowish basally; 16 segments, the fifth with a stem two and one-half times the length of the subcylindric basal enlargement, the latter with a length nearly thrice its

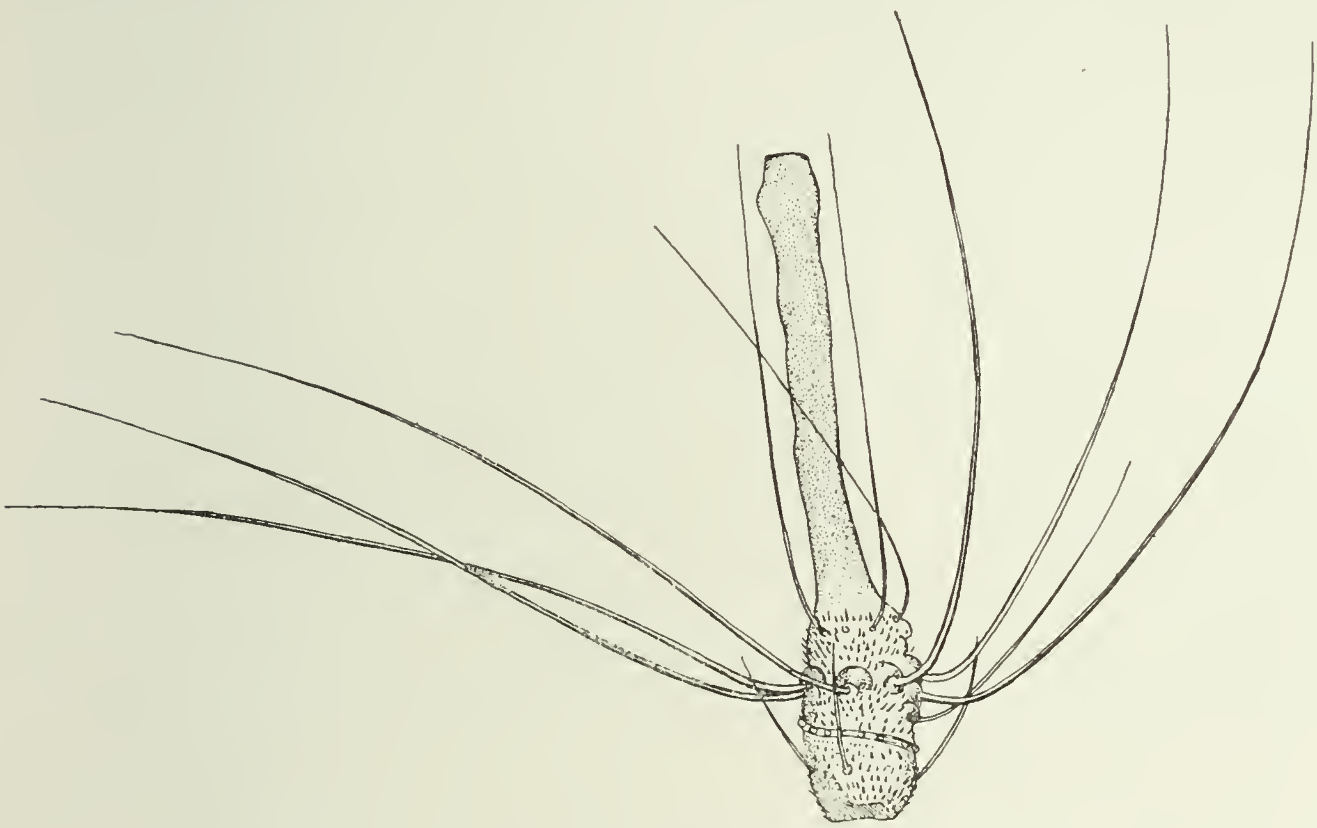


Fig. 17 Colpodia diervillae; fifth antennal segment of male, enlarged (original)

diameter; terminal segment narrowly oval, obtusely rounded. Palpi; the first segment short, subquadrate, the second very long, slender, possibly composed of two fused, the third more slender, less than one-half as long as the second, the fourth one-half longer and more slender than the third. Face yellowish. Mesonotum reddish, submedian lines yellow. Scutellum, postscutellum and abdomen pale yellowish. Wings very long, narrow, hyaline, costa dark brown. Halteres pale yellowish. Legs a nearly uniform dark brown; claws simple, long, uniformly curved. Genitalia; basal clasp segment stout, obliquely truncate; terminal clasp segment short, stout, subtruncate and at the internal angle a stout, chitinous spur one-fifth the length of the segment. Dorsal plate broad, deeply and triangularly incised; ventral plate apparently narrow, narrowly rounded. Harpes diverging basally, approximate distally, with a heavy, recurved, acute spine; at the distal third there is a heavy, chitinous spine, possibly connected with this organ; style long, narrow, acute. (Plate 5, figure 3.) Type Cecid. 485.

Colpodia carolinae Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 145 (separate, p. 49) (Porricondyla)
1908 ——— N. Y. State Mus. Bul. 124, p. 417

One male was taken on the window of a forest hut at Davidson's River, N. C., September 26, 1906.

Male. Length 1.3 mm. Antennae one-half longer than the body, sparsely haired, yellowish brown, yellowish basally; 16 segments, the fifth with a stem twice the length of the basal cylindric enlargement, the latter with a length hardly twice its diameter; terminal segment subconical. Palpi; the first segment curved, slender and about as long as the slightly stouter second and the subequal third, the fourth nearly twice the length of the third. Face yellowish. Mesonotum fuscous yellowish, submedian lines yellowish, the area between the submedian lines distinctly lighter than the sublateral areas. Scutellum reddish brown, postscutellum yellowish. Abdomen fuscous yellowish, genitalia slightly fuscous. Wings (Plate 4, figure 2) hyaline, costa light brown. Halteres yellowish basally, fuscous apically. Legs a nearly uniform yellowish fuscous, claws probably simple. Genitalia, basal clasp segment stout, obliquely truncate; terminal clasp segment rather stout, with a conspicuous subapical spine. Dorsal plate slender, deeply emarginate, the lobes broadly rounded, ventral plate obliquely narrowed posteriorly, deeply emarginate, the lobes subacute. Harpes heavily chitinized distally, with a strongly curved, sublateral tooth and an equally heavy submedian chitinous tooth; style strongly curved. (Plate 5, figure 1). Type Cecid. a1624.

Colpodia capitata Felt

1914 **Felt, E. P.** N. Y. Ent. Soc. Jour. 22:125

The midge is easily separated from the allied C. carolinae Felt by the longer basal enlargement of the flagellate antennal segments and the peculiar genitalia. It was taken August 1909 by Mr C. P. Alexander at Woodworth's lake in the Adirondacks, altitude 1550 feet. A detailed description is given in the citation above.

Colpodia pectinata Felt

1907 **Felt, E. P.** New Species of Cecidomyiidae II, p. 23 (Bryocrypta)
1908 ——— N. Y. State Mus. Bul. 124, p. 304

This peculiar species was reared at Albany, N. Y., August 8, 1907 from a jar containing basswood, Tilia americana, leaves bearing irregular, subglobular swellings at the base or along the midrib. It is probable that this insect emerged from the debris in the jar.

Male. Length 1.75 mm. Antennae about one-fourth longer than the body, sparsely haired, pale yellowish; 16 segments, the fifth with a stem two and one-half times the length of the subcylindric basal enlargement, the latter with a length one-half greater than its diameter; terminal segment somewhat produced, tapering to a subacute apex. Palpi; the first segment rather long, slender, the second a little longer, stouter than the first, the third a little longer than the second and the fourth about one-half longer than the third, more slender basally, slightly dilated apically. Mesonotum light yellowish. Scutellum, postscutellum and abdomen pale yellowish. Wings hyaline, costa pale straw. Halteres yellowish transparent. Legs a nearly uniform yellowish straw; claws rather long, slender, strongly curved, unidentate, the pulvilli rudimentary or wanting. Genitalia; basal clasp segment very short, stout, truncate distally; terminal clasp segment very short, stout, apically with a closely set row of chitinous teeth, other structures indistinct in the preparation. Type Cecid. a1599.

Colpodia ovata Felt

1914 **Felt, E. P.** N. Y. Ent. Soc. Jour. 22:125

This midge is related to C. d i e r v i l l a e Felt and was taken by Mr C. P. Alexander August 24, 1909 in a quarry at Woodworth's lake in the Adirondacks, altitude 1540 feet. Detailed descriptions are given in the citation above.

ASYNAPTA H. Lw.

1850 **Loew, H.** Dipt. Beitr., 4:20, 39
1860 **Rondani, C.** Atti Soc. Ital. Sci. Nat. Milano, 2:2, 5, 8
1862 **Osten Sacken, C. R.** Mon. N. Am. Dipt., 1:177
1876 **Bergenstamm, J. E. & Low, Paul.** Syn. Cecidomyidarum, p. 22
1877 **Karsch, F. A. F.** Revis. de Gallmucken, p. 14
1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:37, 40, 44, 123
1892 **Rubsaamen, E. H.** Berln. Ent. Zeitschr., 37:329, 400
1892 **Theobald, F. V.** Acct. Brit. Flies, 1:51, 84
1894 **Kieffer, J. J.** Soc. Ent. Fr. Ann., 63:313, 339
1896 ——————— Berln. Ent. Zeitschr., 41:3, 6, 29
1897 ——————— Syn. Cecid. de Eur. & Alg., p. 46
1900 ——————— Soc. Ent. Fr. Ann., 69:446-47
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 420
1911 ——————— N. Y. Ent. Soc. Jour., 19:40
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 280

Members of this genus have four long veins, the crossvein lying nearly parallel to costa and the third joining the margin at or a little beyond the apex. The antennal segments are stemmed in the male, sessile in the female and usually composed of more than 16 segments, one American species having 28. The palpi are long' quadriarticulate. Rubsaamen has illustrated the wing of A. l o n g i c a u d a H. Lw., showing subcosta uniting with the margin at the basal third, the third vein with the base somewhat curved,

joined to the middle of subcosta by a straight, parallel crossvein and uniting with the margin at the apex; the fifth joins the posterior margin at the distal fourth, the sixth near the basal half. The claws are slender, short and the pulvilli large and broad. The type species, Cecidomyia longicollis H. Lw., was fixed by Karsch, though seven years earlier Rondani designated C. pectoralis Winn. as the type. The latter, however, was not before Loew, when the genus was erected, and is not even congeneric. Later Kieffer cites this species as the type and then in 1897 mentions A. longicauda H. Lw., as the typical form. The type species, namely, A. longicollis H. Lw., has 24 sessile segments in the female, the male having 21 segments, the stem of the flagellate segments being three-fourths the length of the basal enlargement. Kieffer states that the male genitalia has the claw large and club-shaped.

Key to species

a 16 antennal segments

b Fifth antennal segment with a stem three-fourths the length of the basal enlargement .... nobilis Felt, C. 1464

bb Fifth antennal segment with a stem one-half longer than the basal enlargement

c Abdomen yellowish brown, length 2 mm, the basal enlargement of the fifth antennal segment with a length three times its diameter, the terminal clasp segment broadly triangular..... furcata Felt, C. 336

bbb Fifth antennal segment with a stem two and one-half times the length of the basal enlargement

c Abdomen yellowish brown, length 2.75 mm, basal enlargement of fifth antennal segment with a length one-half greater than its diameter, terminal clasp segment with a spur at the apical fourth.............. apicalis Felt, C. 1492

cc Abdomen fuscous yellowish, length 2.5 mm, basal enlargement of the fifth antennal segment with a length twice its diameter, terminal clasp segment with a spur near the basal half.. mediana Felt, C. 1495

aa 17 or 18 antennal segments, the fifth with a stem about three-fourths the length of the basal enlargement

b Abdomen light yellow, length 2 mm, the basal enlargement of the fifth antennal segment with a length three-fourths greater than its diameter flavida Felt, C. 504

bb Abdomen fuscous yellowish, length 1.5 mm, the basal enlargement of the fifth antennal segment with a length one-fourth greater than its diameter umbra Felt, C. 1499

aaa 19 antennal segments

b Fifth antennal segment with a stem in the male three-fourths, and in the female one-fifth, the length of the basal enlargement

c Abdomen reddish orange, length, male, 2 mm, female 1.5 mm, the basal enlargement of the fifth (male) antennal segment with a length twice its diameter. Reared from Rhabdophaga batatas gall on willow...... saliciperda Felt, C. a1815a

aaaa 20 or more antennal segments
b Antennal segments subsessile, females
c Abdomen whitish yellow, antennal segments 22, the fifth with a length three-fourths greater than its diameter, the ovipositor nearly as long as the abdomen . . . . frosti Felt, C. 1424
cc Abdomen yellowish orange, 23 antennal segments, the fifth with a length three-fourths its diameter, the ovipositor one-half the length of the abdomen . . . . mangiferae Felt, C. a1955
bb Antennal segments stemmed, males
c Fifth antennal segment with a stem three-fourths the length of the basal enlargement
d Abdomen fuscous yellowish, 21 antennal segments, the fifth having the basal enlargement with a length one-fourth greater than its diameter . . . . americana Felt, C. 1399
cc Fifth antennal segment with a stem as long as the basal enlargement
d Abdomen reddish brown, length 2 mm, 21 antennal segments, the basal enlargement of the fifth with a length one-half greater than its diameter . . . . caudata Felt, C. 1219
dd Abdomen orange yellow, length 1.5 mm, 23 antennal segments, the basal enlargement of the fifth with a length three-fourths greater than its diameter . . . . cerasi Felt, C. 236
ddd Abdomen light brown, length 1.5 mm, 23 antennal segments, the basal enlargement of the fifth with a length twice its diameter . . . . canadensis Felt, C. 1335

Asynapta nobilis Felt

1913 **Felt, E. P.** Psyche, 20:135, 142–43

Described from a specimen collected by C. W. Johnson at Bridgeton, Me., August 25.

Asynapta furcata Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 148 (separate, p. 52) (Winnertzia)
1908 ———— N. Y. State Mus. Bul. 124, p. 420

This species was taken June 21, 1906, at Nassau, N. Y.

Male. Length 2 mm. Antennae as long as the body, sparsely haired, fuscous; 16 segments, the fifth with a stem one-half longer than the basal enlargement, which latter has a length thrice its diameter; terminal segment with a rudimentary distal stem. Palpi; the first three segments subequal, the fourth slender and about twice the length of the preceding. Head testaceous. Mesonotum dark, sparsely clothed with long hairs. Scutellum and postscutellum testaceous. Abdomen testaceous with dark lateral edges and sparsely clothed with short, pale hairs. Wings hyaline, costa dark brown. Halteres long, pale straw. Legs testaceous at base, becoming dark brown at the tibiae, the two basal tarsal segments of the anterior legs brown, the others pale. The basal segment and most of the second of the posterior legs brown, the tip of the second and the remaining segments white, articulations pale straw; claws rather stout, slightly curved, unidentate and apparently with a very fine

tooth at the base of the well-marked stout one. Genitalia; basal clasp segment stout; terminal clasp segment stout, broad, irregularly triangular. Dorsal plate very broad, the lobes nearly truncate; ventral plate deeply emarginate, the lobes broadly rounded and widely separated. Harpes stout, convolute, truncate. Harpagones rather narrow, stout, apparently fused distally into a median chitinous spur and each bearing at its lateral posterior angle a stout, bifurcate process, each branch broadly rounded; style slender, broadly rounded. Type Cecid. 336.

Asynapta apicalis Felt

1914 **Felt, E. P.** N. Y. Ent. Soc. Jour. 22:127

The male was taken August 24, 1909 by Mr C. P. Alexander in a quarry at Woodworth's lake in the Adirondacks, elevation 1540 feet. It is related to A. f u r c a t a Felt

Asynapta mediana Felt

1914 **Felt, E. P.** N. Y. Ent. Soc. Jour. 22:128

The male was taken August 28, 1909 by Mr C. P. Alexander in a quarry at Woodworth's lake in the Adirondacks, altitude 1540 feet. It is allied to A. a p i c a l i s Felt.

Asynapta umbra Felt

1914 **Felt, E. P.** N. Y. Ent. Soc. Jour. 22:128

The midge was taken by Mr C. P. Alexander in Johnstown Cemetery August 6, 1909. It is related to A. f l a v i d a Felt.

Asynapta flavida Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 421

A male was taken on a window at Nassau N. Y. July 6, 1906.

Male. Length 2 mm. Antennae nearly as long as the body, sparsely haired, fuscous straw, yellowish basally; 18 segments, the fifth with a stem three-fourths the length of the ovate basal enlargement, which latter has a length about twice its diameter; terminal segment produced, irregularly conic, with a length twice its diameter, occasionally fused with the preceding. Palpi; first segment with a length three times its diameter, incrassate, the second as long as the first, subquadrate, the third one-half longer than the second, more slender, the fourth a little longer and more slender than the third. Face pale yellowish. Mesonotum dark brown, the submedian lines narrow, yellowish. Scutellum pale yellowish with sparse apical setae, postscutellum fuscous yellowish. Abdomen a nearly uniform light yellowish, slightly tinged with orange basally; genitalia fuscous, sparsely setose. Wings hyaline, membrane thickly red-haired, costa light brown. Halteres yellowish transparent. Coxae or basal portion of femora pale yellowish, the distal part of femora and tibiae fuscous straw, the tarsi slightly darker; claws long, evenly curved, unidentate, the pulvilli as long as the claws. Genitalia; basal clasp segment stout, obliquely truncate;

terminal clasp segment short, greatly swollen near the middle; dorsal plate long, the lobes divided, parallel, broadly rounded; ventral plate short, broadly and roundly emarginate, the lobes well separated, narrowly rounded. Harpes apparently truncate, irregular. Type Cecid. 504.

Asynapta americana Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour. 20: 103–4

This species, easily separated by the shorter antennal stem, was taken at Hazelton, Pa., April 13, 1910, by Dr W. S. Dietz.

Asynapta mangiferae Felt

1909 **Felt, E. P.** Ent. News, 20: 299–300

This West Indian species was reared by Prof. H. A. Ballou, government entomologist, from maggots found under the bark of small twigs of grafted Mango, probably Mangifera indica.

Asynapta saliciperda Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 421
1909 ——————— Ent. Soc. Ont. 39th Rep't, p. 46

Several examples of this species were reared in early April 1907, from a typical dry and old Rhabdophaga batatas O. S. gall received from Mr L. H. Weld of Evanston, Ill.

Male. Length 2 mm. Antennae as long as the body, sparsely haired, fuscous yellowish, 19 segments, the fifth with a stem three-fourths the length of the subcylindric basal enlargement, which latter has a length nearly twice its diameter; terminal segment produced, with a length nearly five times its diameter, tapering to a narrowly rounded apex. Palpi; the first segment short, stout, narrowly oval, the second broad, subrectangular, with a length fully one-half greater than the first, the third long, rather stout, with a length about twice the third, the fourth slender and about three-fourths longer than the third. Face fuscous yellowish, mesonotum dark brown, submedian lines sparsely haired, yellowish, scutellum reddish orange, postscutellum fuscous orange, abdomen a nearly uniform reddish orange, the segments sparsely haired posteriorly, membrane and pleurae reddish orange, genitalia light fuscous yellowish, wings hyaline, costa yellowish brown; halteres yellowish basally, reddish orange apically, coxae reddish orange, femora, tibiae and tarsi a light fuscous yellowish. Claws long, slender, evenly curved, unidentate, the pulvilli a little shorter than than the claws. Basal clasp segment long, stout, roundly truncate, terminal clasp segment short, slender basally, greatly swollen near the distal third and with a heavily chitinized dentate apex.

Female. Length 1.5 mm. Antennae extending to the second abdominal segment, sparsely haired, dark brown; 19 segments, the

fifth with a stem about one-fifth the length of the subcylindric basal enlargement, which latter has a length about twice its diameter; terminal segment produced, tapering to a subacute apex. Palpi; the first segment rather long, slender, rectangular; the second twice the length of the first, rather stout, the third twice the length of the second, slender; and the fourth one-half longer than the third, more slender. Mesonotum dark reddish brown; the submedian lines sparsely haired; scutellum reddish brown, postscutellum

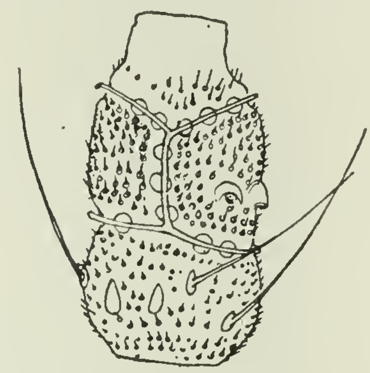


Fig. 18 Asynapta saliciperda; fifth antennal segment of female, enlarged (original)

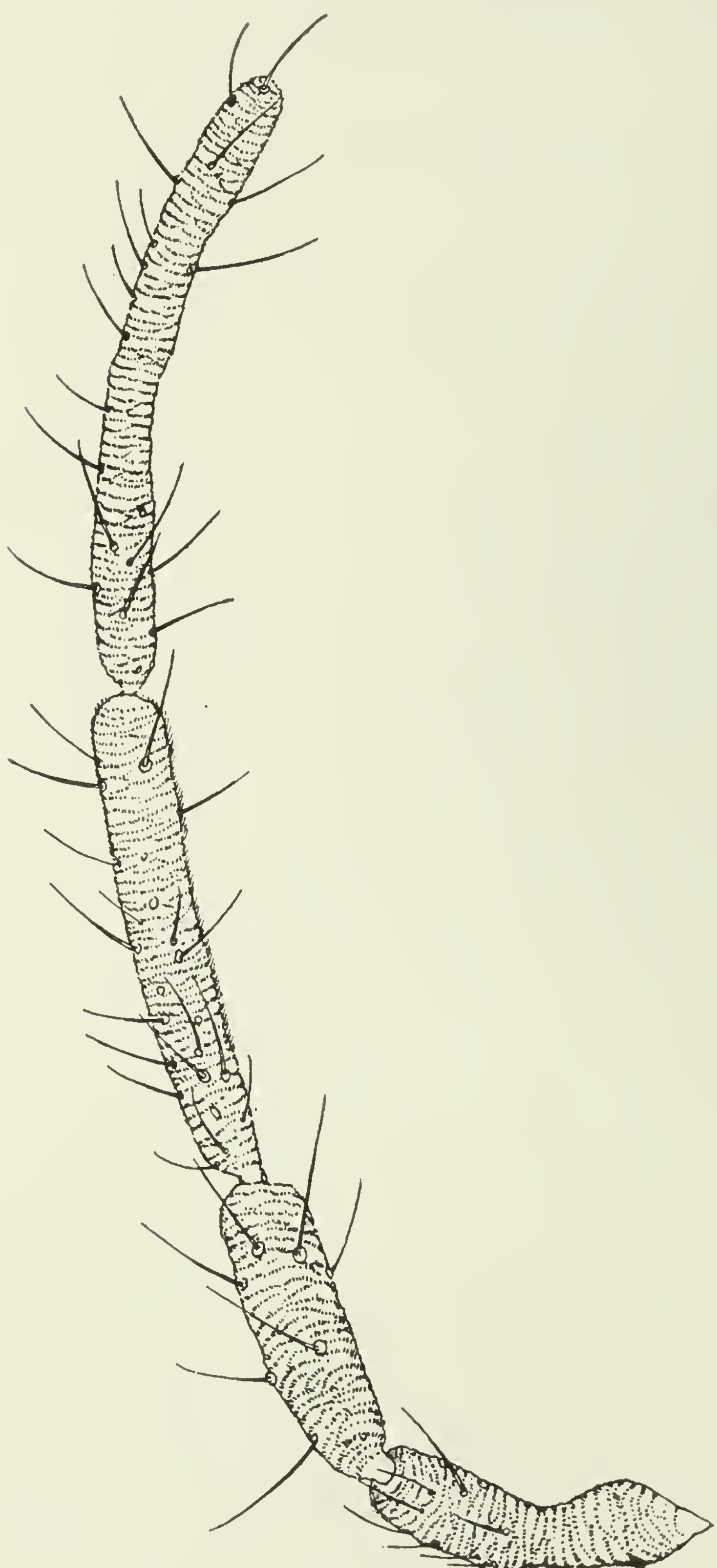


Fig. 19 Asynapta saliciperda; palpus, enlarged (original)

yellowish; abdomen yellowish orange, rather thickly clothed with yellowish setae; halteres pale yellowish. Coxae, femora and tibiae

mostly pale yellowish, tarsi light fuscous. Claws long, slender, strongly curved, unidentate, the pulvilli shorter than the claws. Ovipositor pale orange, upturned, about as long as the abdomen,

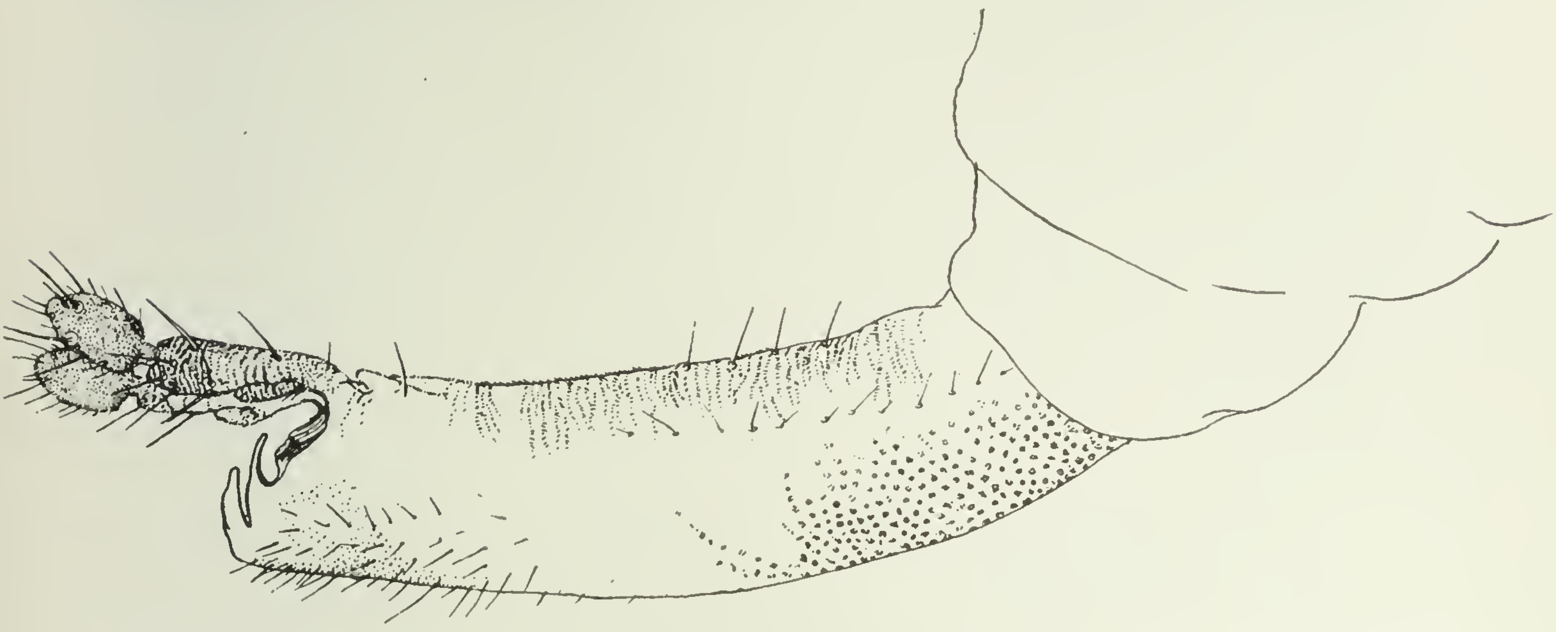


Fig. 20 Asynapta saliciperda; tip of ovipositor, enlarged (original)

the terminal lobes long, biarticulate, the terminal segment narrowly oval. Type Cecid. a1815a.

Asynapta frosti Felt

1913 **Felt, E. P.** Psyche, 20: 135, 143

Described from a specimen found by C. A. Frost, Framingham, Mass., in a jar containing sumac twigs and bees' nests June 1, 1910.

Asynapta caudata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 421

A male was taken on a window at Albany, N. Y., June 26, 1907.

Male. Length 2 mm. Antennae nearly as long as the body, sparsely haired, presumably pale yellowish; 21 segments, the fifth with a stem as long as the subcylindric basal enlargement, which latter has a length about one-half greater than its diameter; the penultimate segment subcylindric, sessile, the terminal one produced, irregularly subconical. Palpi; the first segment long, slender, with a length fully four times the diameter, the second about as long as the first, stouter, the third one-half longer than the second, more slender and the fourth a little longer than the third. Mesonotum presumably dark brown with yellowish, sparsely haired submedian lines. Scutellum and postscutellum probably yellowish brown, the abdomen presumably reddish brown. Wings hyaline, costa pale yellowish. Halteres probably pale yellowish. Legs presumably a pale straw; claws short, slender, strongly curved, unidentate, the pulvilli longer than the claws. Genitalia; basal clasp segment stout, obliquely rounded and with a conspicuous internal angle apically; terminal clasp segment stout, greatly swollen near the

middle, obtuse; dorsal plate very long, slender, deeply incised, the lobes long, narrow, narrowly rounded; ventral plate long, slender, deeply incised, the lobes long, slender, narrowly rounded. Harpes approximate, short, stout, narrowly rounded. Type Cecid. 1219.

Asynapta cerasi Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 147–48 (separate, p. 51)
1908 ———— N. Y. State Mus. Bul. 124, p. 421

This species was taken at Albany, N. Y., June 21, 1906 on cherry, Prunus species.

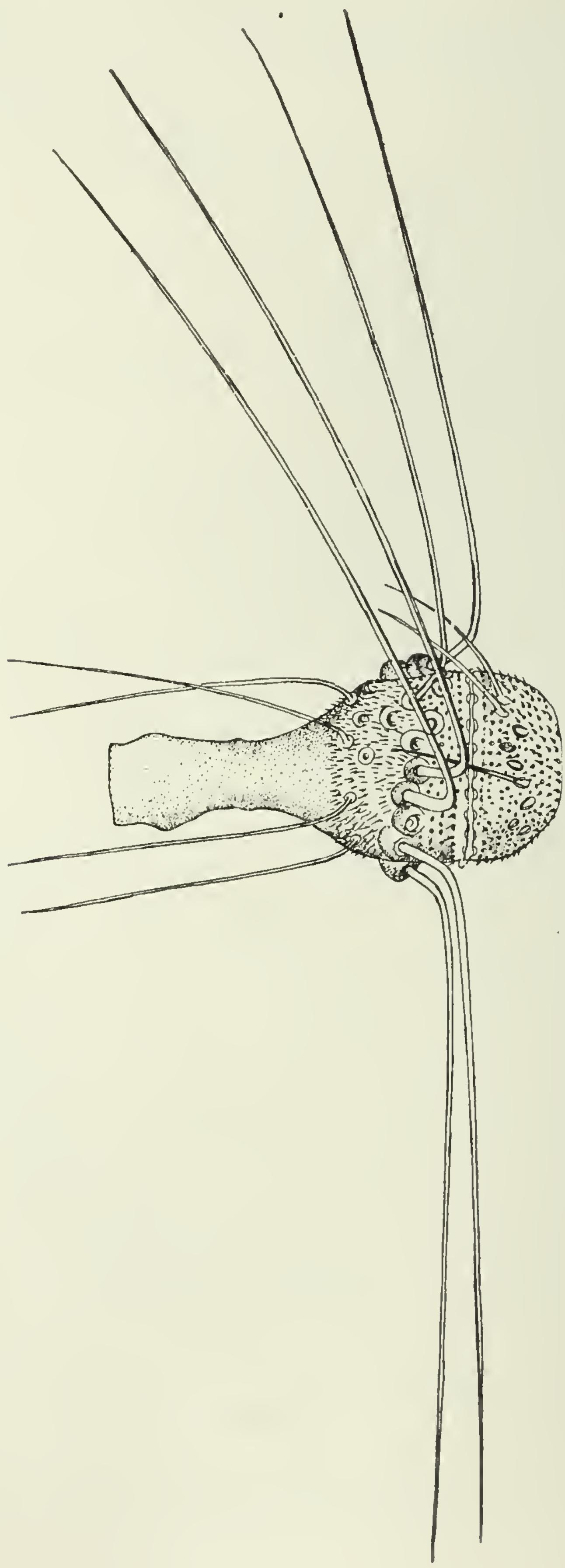


Fig. 21 *Asynapta cerasi*; seventh antennal segment of male, enlarged (original)

Male. Length 1.5 mm. Antennae about as long as the body, rather thickly white haired, light brown, yellowish basally; 23 segments, the fifth with a stem as long as the subcylindric basal enlargement, which latter has a length three-fourths greater than its diameter; terminal segment prolonged, conical. Palpi; the first segment rather prolonged, incrassate, the second twice the length of the first, stout, the third twice the length of the second, slender, the fourth one-fourth longer than the third, more slender. Face pale yellowish. Mesonotum rather dark brown, the posterior median area yellowish, submedian lines narrow, distinct, yellowish, ornamented with coarse setae. Scutellum pale orange yellow with sparse apical setae, postscutellum pale orange yellow. Abdomen somewhat variable orange yellow, genitalia slightly fuscous. Wings (Plate 4, figure 7) hyaline, costa light brown. Halteres yellowish at the base, pale fuscous along the stem and whitish fuscous apically. Coxae pale yellowish orange. Legs a rather dark straw brown, lighter ventrally; claws stout, evenly curved, unidentate. Genitalia (Plate 7, figure 3); basal clasp segment stout, truncate; terminal clasp segment short, stout, with a heavy series of teeth. Dorsal plate broad, apparently divided, the lobes stout, diverging at the distal third, broadly rounded; minor lobes apparently divided, the distal third tapering to a subacute setose apex. Harpes short, stout, strongly chitinized and very irregular, the style short, narrow, heavily chitinized, extending anteriorly. Type Cecid. 236.

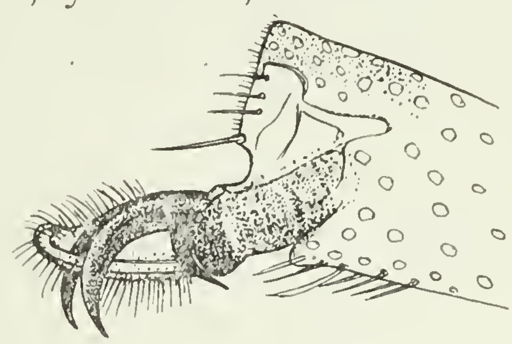


Fig. 22 Asynapta cerasi; lateral view of claw and tip of last tarsal segment of male, enlarged (original)

Asynapta canadensis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 421

The species was received from the Museum of Comparative Zoology through the courtesy of Samuel Henshaw and bore a blue label marked as follows: "✕ 201, Can. Belanger."

Male. Length 1.5 mm. Antennae longer than the body, thickly haired, fuscous yellowish, yellowish basally; 23 segments, the fifth with a stem as long as the cylindric basal enlargement, which latter has a length twice its diameter. Palpi; first segment short, stout, the second narrowly oval, with a length three and one-half times its diameter, the third about twice the length of the second, slender, the fourth one-half longer than the third, slender. Face yellowish. Mesonotum reddish brown, the submedian lines yellowish. Scutellum and postscutellum yellowish. Abdomen rather thickly haired, light brown; genitalia fuscous brown. Wings hyaline, costa light straw. Halteres yellowish transparent. Coxae, femora and tibiae light brown, tarsi a little darker; claws long, stout, evenly curved, unidentate, the pulvilli as long as the claws. Genitalia; basal clasp segment stout, obliquely truncate; terminal clasp segment

short, stout, curved; dorsal plate long, the lobes nearly parallel, narrowly rounded and sparsely clothed with coarse setae apically; ventral plate short, deeply and triangularly emarginate, the lobes tapering to a narrowly rounded, sparsely haired apex. Type Cecid. 1335.

PORRICONDYLA Rond.

Epidosis H. Lw.

Dicroneurus Kieff. sub. gen.

1840 **Rondani, C.** Mem. IIa p. s. a. Ditterol. Ital. Parma, p. 14
1846 ———— Nouv. Ann. Sci. Nat. Bologna, p. 370, 374
1850 **Loew, H.** Dipt. Beitr., 4: 20, 21 (Epidosis)
1862 **Osten Sacken, C. R.** Dipt. N. Am., 1: 177 (Epidosis)
1863 **Schiner, J. R.** Fauna Austriaca Dipt., 2: 402 (Epidosis)
1876 **Bergenstamm, J. E. & Low, Paul.** Syn. Cecidomyidarum, p. 23, 24
1877 **Karsch, F. A. F.** Revis. de Gallmucken, p. 15
1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3: 37, 40, 44, 115 (Epidosis)
1892 **Rubsaamen, E. H.** Berln. Ent. Zeitschr., 37: 329, 397 (Epidosis)
1892 **Theobald, F. V.** Acct. Brit. Flies, 1: 51 (Epidosis)
1894 **Kieffer, J. J.** Soc. Ent. Fr. Ann., 63: 313, 315, 318 (Epidosis)
1895 ———— Berln. Ent. Nachr., 21: 122 (Dicroneurus)
1896 ———— Berln. Ent. Zeitschr., 41: 2, 3, 6, 20, 21, 23 (Epidosis, Dicroneurus)
1897 ———— Syn. Cecid. de Eur. & Alg., p. 44, 45 (Epidosis, Dicroneurus)
1900 ———— Soc. Ent. Fr. Ann., 69: 441, 446 (Epidosis, Porricondyla)
1904 **Meunier, F.** Soc. Sci. Brux. Ann., 28: 8 (Dicroneurus)
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 417
1911 ———— N. Y. Ent. Soc. Jour., 19: 40
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 271

Members of this genus may be recognized by the possession of three long veins, the crossvein running parallel or nearly so to costa in connection with the forked fifth vein and the antennal segments in both sexes being greatly produced. The males usually have 16, rarely 15, antennal segments, the flagellate ones provided with a long, and sometimes a very long stem. The females usually have 12 to 14 antennal segments, the stem one-fourth to one-third the length of the basal enlargement. Kieffer has proposed to divide this group into two subgenera, namely, Porricondyla s. str. comprising those forms having the basal enlargement in the male antennae subspherical, while those of the female are more or less double or strongly contracted in the middle in connection with the claws being strongly curved and enlarged subapically; the other, Dicroneurus to include those species having the antennal segments cylindric in both sexes, the claws arched and not enlarged subapically. He has recently proposed a more detailed classification of this genus, see page 130. The type of the genus Porricondyla is Cecidomyia albitarsis Meign.

A West Indian species, P. g o s s y p i i Coq.[1] may belong in this genus. It is recorded as living in cotton stems without producing an enlargement.

Key to species

a 12 antennal segments; females

b Fifth antennal segment with a stem about one-fourth the length of the basal enlargement

c Abdomen dark brown: length 1.5 mm, the fifth antennal segment with a stem one-third the length of the basal enlargement, which latter has a length five times its diameter; palpi moderate, the fourth segment nearly twice the length of the second; terminal lobes of the ovipositor oval and with a length twice the width...............q u e r c i n a Felt, C. 62

cc Abdomen yellowish brown; length 1.3 mm, the fifth antennal segment with a stem one-third the length of the basal enlargement, which latter has a length four times its diameter; palpi long, the fourth segment one-half longer than the third; ovipositor lobes narrowly oval, sparsely setose...............................p o r r e c t a Felt, C. a1628

ccc Abdomen reddish orange; length 1.5 mm, the fifth antennal segment with a stem one-fourth the length of the basal enlargement, which latter has a length three times its diameter; palpi moderate, the fourth segment one-half longer than the third; ovipositor lobes narrowly oval, thickly setose.................a n t e n n a t a n. sp., C. 1360

cccc Abdomen dark yellowish brown, length 1.75 mm, the fifth antennal segment with a stem one-fourth the length of the cylindric basal enlargement, which latter has a length three times its diameter, the fourth palpal segment one-half longer than the third; ovipositor lobes biarticulate, the basal portion narrowly oval, the distal segment fusiform.................n o v a e-a n g l i a e Felt, C. 1503

bb Fifth antennal segment with a stem one-third the length of the basal enlargement

c Abdomen yellowish, mesonotum black..................d i e t z i i Felt

bbb Fifth antennal segment with a stem one-half the length of the basal enlargement

c Abdomen reddish brown, mesonotum almost black......d o r s a t a Felt

aa 13 antennal segments, the fifth with a stem one-fourth the length of the basal enlargement; females

b Abdomen fuscous yellowish, length 2 mm, the basal enlargement of the fifth antennal segment with a length three and one-half times its diameter; terminal lobes of the ovipositor narrowly oval, with a length three and one-half times the width.....................t u c k e r i Felt, C. 1255

bb Abdomen fuscous yellowish, basal enlargement of fifth antennal segment with a length twice its diameter, terminal lobes of the ovipositor with a length twice the width.....................v e r n a l i s Felt, C. 1401

bbb Abdomen dark brown, length 1.75 mm, the basal enlargement of the fifth antennal segment with a length four times its diameter; terminal lobes of the ovipositor lanceolate..............s e t o s a Felt, C. 1487

bbbb Abdomen reddish yellow, length 2.5 mm, the basal enlargement of the fifth antennal segment with a length four times its diameter, the ter-

[1] Coquillett, D. W. Can. Ent., 37: 200, 1905.

minal lobe of the ovipositor tapering, with a length fully four times its width . . . . caudata Felt, C. 531

aaa 14 antennal segments

b Fifth antennal segment with a stem one-fourth or one-third the length of the basal enlargement; females

c Abdomen brown, the dorsal sclerites heavily chitinized anteriorly and posteriorly, length 1.5 mm . . . . karnerensis Felt, C. 30

cc Abdomen dark reddish brown, the dorsal sclerites evenly chitinized, length 1.5 mm . . . . carolina Felt, C. a1625

ccc Abdomen yellowish brown, the dorsal sclerites evenly chitinized, length 3 mm . . . . papillata Felt, C. 1502

bb Fifth antennal segment with a stem one-half the length of the basal enlargement

c Abdomen fuscous yellowish, length 2 mm, the basal enlargement of the fifth antennal segment with a length three and one-half times its diameter, fourth palpal segment one-third longer than the third

borealis Felt, C. 155

aaaa 16 antennal segments; males

b Fifth antennal segment with a stem as long as the basal enlargement

c Abdomen fuscous yellowish, length 2 mm, the basal enlargement of the fifth antennal segment with a length twice its diameter

canadensis Felt, C. 1334

bb Fifth antennal segment with a stem one-half longer than the basal enlargement

c Abdomen dark brown, length 1.5 mm, the basal enlargement of the fifth antennal segment with a length twice its diameter; terminal clasp segment greatly enlarged apically . . . . pini Felt, C. 221

cc Abdomen orange yellow, length 1.5 mm, basal enlargement of the fifth antennal segment with a length one and three-fourths times its diameter; terminal clasp segment greatly swollen basally

dilatata Felt, C. a1149

bbb Fifth antennal segment with a stem twice the length of the basal enlargement

c Abdomen light yellowish brown, length 2 mm, the basal enlargement of the fifth antennal segment with a length two and one-half times its diameter; terminal clasp segment elongate, not greatly swollen near the middle . . . . barberi Felt, C. 948

cc Abdomen light yellowish, length 1 mm, the basal enlargement of the fifth antennal segment with a length twice its diameter, the terminal clasp segment short, not greatly enlarged apically . . flava Felt, C. 151

bbbb Fifth antennal segment with a stem two and one-half times the length of the basal enlargement

c Abdomen fuscous yellowish, length 3 mm, the basal enlargement of the fifth antennal segment with a length twice its diameter; terminal clasp segment enlarged apically . . . . hamata Felt, C. a1626

cc Abdomen dark yellowish, terminal clasp segment not greatly enlarged apically . . . . juvenalis Felt, C. a2350

ccc Abdomen yellowish white, the segments brown banded, length 2 mm, the basal enlargement of the fifth antennal segment with a length one-half greater than its diameter; terminal clasp segment short, greatly swollen near the middle . . . . wellsi n. sp., C. 1564

Porricondyla quercina Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 147 (separate, p. 50–51)
1908 ———— N. Y. State Mus. Bul. 124, p. 418

A female was taken at Karner, N. Y., May 19, 1906, presumably on scrub oak, Quercus prinoides. A very similar form was collected May 25 at Kaslo, B. C., by Dr H. G. Dyar.

Female. Length 1.5 mm. Antennae as long as the body, thickly haired, dark brown; 12 segments, the fifth with a stem one-third the length of the subcylindric enlargement; terminal segment slightly produced. Palpi; first segment stout, the second as long as the first, stouter, the third a little longer than the second, more slender, the fourth one-fourth longer than the third. Mesonotum dark brown, the sublateral and median posterior areas yellow. Scutellum pale reddish, postscutellum yellow. Abdomen dark brown. Wings hyaline, costa dark brown. Halteres reddish transparent basally, reddish fuscous apically. Legs, coxae and base of femora yellowish, distal portion of femora yellowish brown; tibiae and tarsi dark brown; claws stout, uniformly curved, unidentate. Ovipositor short, terminal lobes suboval. Type Cecid. 62.

Porricondyla antennata n. sp.

This species was taken July 11, 1909 on low grasses in the vicinity of water at Johnstown, N. Y., by Mr C. P. Alexander.

Female. Length 1.5 mm. Antennae about as long as the body, sparsely haired, fuscous yellowish; 12 segments, the fifth with a stem one-fourth the length of the cylindric basal enlargement, which latter has a length thrice its diameter; terminal segment produced, with a length six times its diameter, a constriction at the distal third. Palpi; the first segment with a length about three times its diameter, the second broadly oval, the third one-half longer and more slender, the fourth nearly twice the length of the third. Mesonotum dark orange. Scutellum and postscutellum pale orange. Abdomen reddish orange, the segments sparsely haired. Wings hyaline, costa pale straw. Halteres pale yellowish. Legs mostly pale straw; claws rather stout, evenly curved, simple, the pulvilli rudimentary. Ovipositor short, the terminal lobes narrowly oval. Type Cecid. 1360.

Porricondyla novae-angliae Felt

1914 **Felt, E. P.** Psyche 20:110

The structure of the ovipositor distinguishes this species, collected by Mrs A. T. Slosson at Franconia, N. H., from all other females referable to the genus.

Porricondyla porrecta Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20: 105

A female was taken on the window of a forest hut at Davidson's River, N. C., September 26, 1906.

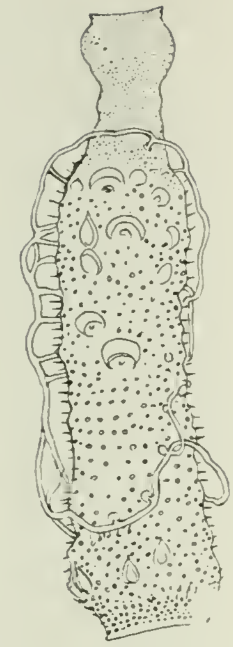


Fig. 23 Porricondyla porrecta; fifth antennal segment of female, enlarged (original)

Porricondyla dietzii Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20: 105

This species was taken June 4, 1910 at Hazelton, Pa., by Dr W. C. Dietz. It is closely allied to P. porrecta from which it is easily separated by the black mesonotum and the perceptibly shorter terminal segments of the antennae and palpi.

Porricondyla dorsata Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20: 238

The midge was taken by Mr D. B. Young at Dug mountain in the Adirondacks August 8, 1912. It is easily separated from other American species of Porricondyla, having 12 antennal segments, by the longer stem of the fifth segment.

Porricondyla tuckeri Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 416

This female was taken by Mr E. S. Tucker in August at Lawrence, Kan., at an elevation of 900 feet. A closely allied female (C. 949) was taken at Las Vegas, N. M., August 14th by Mr H. S. Barber.

Female. Length 2 mm. Antennae nearly as long as the body, thickly haired, dark brown; 13 segments, the fifth with a stem one-fourth the length of the cylindric basal enlargement, which latter has a length about three and one-half times its diameter; terminal segment slightly reduced, tapering to a subacute apex. Palpi; first segment somewhat irregular, with a length four times its diameter, the second a little longer, dilated, the third longer than the second, the fourth about one-half longer than the third. Mesonotum fuscous yellowish, somewhat lighter laterally, he submedian lines broad, indistinct, yellowish. Scutellum fuscous yellowish, postscutellum concolorous. Abdomen rather thickly clothed with long hairs, fuscous yellowish, the dorsum of the first to fourth segments dark brown; genitalia ochreous. Wings hyaline, costa light brown. Halteres yellowish transparent basally, fuscous yellowish apically. Coxae and base of femora mostly yellowish, the distal part of femora and tibiae mostly dark brown, the tarsi yellowish white; claws strongly curved, unidentate, the pulvilli as long as the claws. Ovipositor short, with a small, lanceolate lobe. Type Cecid. 1255.

Porricondyla vernalis Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20: 104–5

The species was taken May 16, 1910 by Dr W. G. Dietz at Hazelton, Pa. It is allied to P. t u c k e r i Felt from which it is easily separated by the stouter antennal segments and the broader lobes of the ovipositor.

Porricondyla setosa Felt

1914 **Felt, E. P.** N. Y. Ent Soc. Jour. 22:129

This midge was taken August 21, 1909 by Mr C. P. Alexander at Woodworth's lake in the Adirondacks, altitude 1570 feet. It is related to P. c a u d a t a Felt.

Porricondyla caudata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 418

Described from a female taken in a trap lantern at Nassau, N. Y., July 9, 1906.

Female. Length 2.5 mm. Antennae extending to the fourth abdominal segment, sparsely haired, fuscous yellowish; 13 segments, the fifth with a stem one-fourth the length of the subcylindric basal enlargement, which latter has a length four times its diameter; terminal segment somewhat reduced, slightly swollen near the distal fourth and tapering to a subacute apex. Palpi; first segment stout, with a length four times its diameter, the second one-fourth longer, stouter, the third a little longer than the second, the fourth one-half longer than the third. Mesonotum dark brown, the submedian lines, postscutellum and scutellum fuscous yellowish, the last with numerous apical setae. Abdomen reddish yellow, the basal three segments dark brown, distal segment yellowish. Wings slightly fuscous, costa light brown. Halteres yellowish basally, whitish apically. Legs a fuscous straw, the third and fourth tarsal segments whitish, the fifth light brown; claws long, evenly curved, unidentate, the pulvilli as long as the claws. Ovipositor short, the terminal lobes with a length four times the width, narrowly rounded. Type Cecid. 531.

Porricondyla karnerensis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 418

This species taken at Karner, N. Y., May 16, 1906.

Female. Length 1.5 mm. Antennae as long as the body, sparsely clothed with coarse setae, dark brown; 14 segments, the fifth with a stem one-third the length of the subcylindric basal enlargement, which latter has a length four times its diameter. Palpi; the first segment subcylindric, much produced, the second a little shorter than the first, the third as long as the first, a little stouter and the

fourth more slender and one-half longer than the third. Mesonotum very dark brown, a yellowish, median area posteriorly. Scutellum prominent, yellowish; postscutellum yellowish brown. Abdomen brown, sparsely clothed with yellowish hairs. Wings hyaline, costa light brown. Halteres yellowish. Legs rather dark brown,

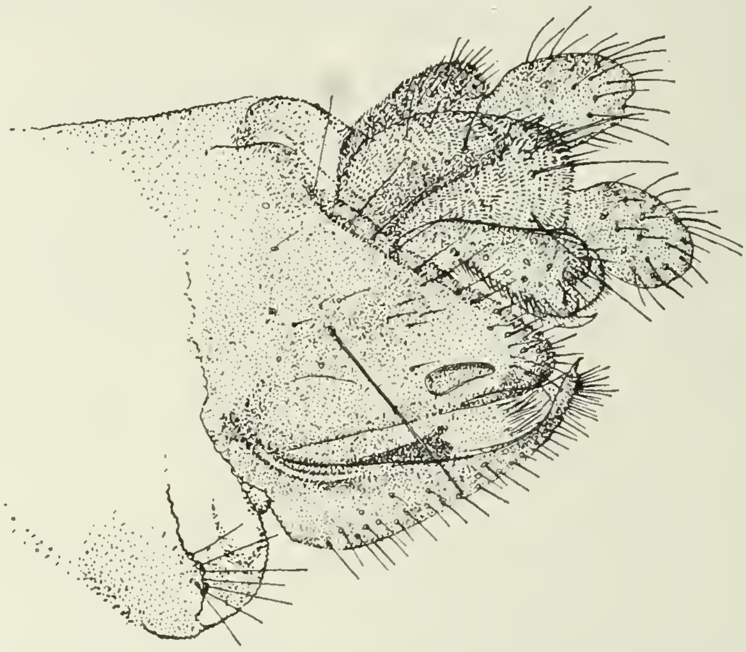


Fig. 24 Porricondyla karnerensis; lateral view of ovipositor and tip of abdomen, enlarged (original)

yellowish ventrally, tarsi slightly darker; claws stout, strongly curved, unidentate. Ovipositor short, the terminal lobes suboval. Type Cecid. 30.

Porricondyla carolina Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 418

A female was taken September 26, 1906 on the window of a woodland hut at Davidson's River, N. C.

Female. Length 2 mm. Antennae shorter than the body, sparsely haired, fuscous straw; probably composed of 14 segments, the fifth with a stem one-half the length of the subfusiform basal enlargement, which latter has a length four times its diameter. Palpi; the first

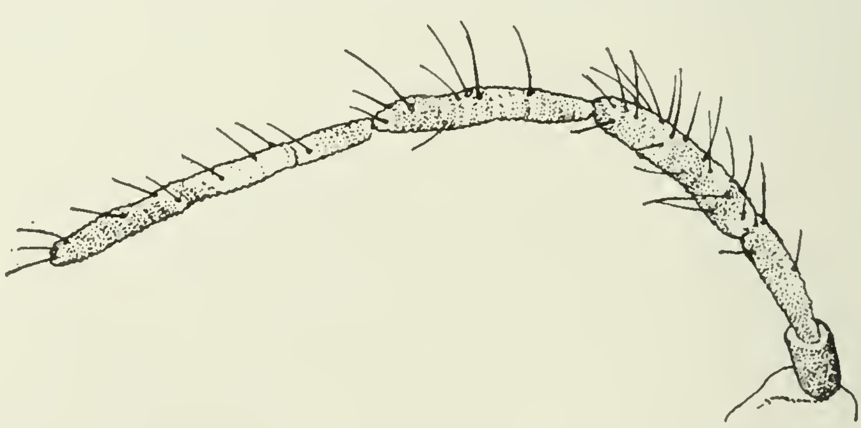


Fig. 25 Porricondyla carolina; palpus, enlarged (original)

and second segments long, slender, subequal, the third a little longer and the fourth one-half longer than the preceding. Mesonotum

fuscous brown, submedian lines yellowish, distinct. Scutellum pale reddish yellow, postscutellum yellowish. Abdomen fuscous, yellowish haired. Wings (Plate 4, figure 6) hyaline, costa dark brown. Halteres yellowish basally, fuscous apically. Legs fuscous yellowish, tarsi lighter; claws probably unidentate. Ovipositor short, lobes suboval. Type Cecid. a1625.

Porricondyla papillata Felt

1914 **Felt, E. P.** Psyche 20:111

This large midge, collected by Mrs A. T. Slosson on Mount Washington is easily recognized by the two large sublateral groups of papillae at the posterior extremity.

Porricondyla borealis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 147 (separate, p. 51)
1908 ———— N. Y. State Mus. Bul. 124, p. 418

The midge was taken on spruce, Picea canadensis, at Lake Clear, N. Y., June 7, 1906.

Female. Length 1.5 mm. Antennae nearly as long as the body, sparsely haired, dark brown, yellowish basally; 14 segments, the fifth with a stem one-third the length of the subcylindric basal

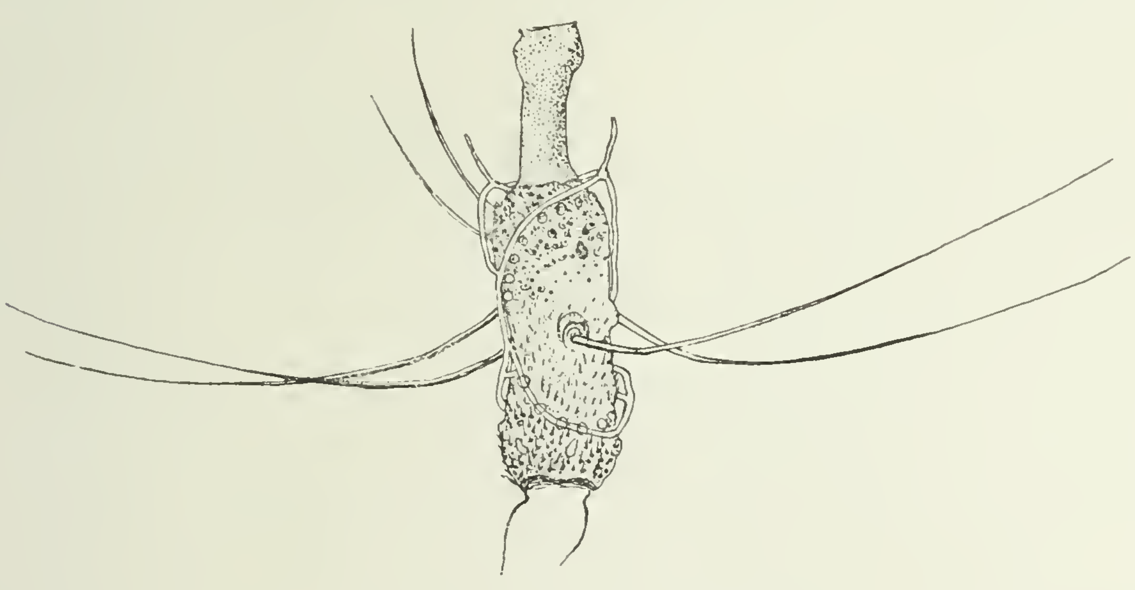


Fig. 26 Porricondyla borealis; sixth antennal segment of female, enlarged (original)

enlargement; terminal segment slightly prolonged, tapering to a narrowly obtuse apex. Palpi; the first segment long and slender, subfusiform, the second twice the length of the preceding, stouter, subfusiform, the third one-half longer than the preceding,

Fig. 27 P o r r i c o n d y l a b o r e a l i s; female palpus, enlarged (original)

slender, subcylindric, the fourth one-half longer than the th'rd, the distal fourth distinctly dilated, flattened. Mesonotum reddish brown, submedian lines yellowish. Scutellum yellowish apically, postscutellum and abdomen dark reddish brown. Wings hyaline. costa light brown. Halteres reddish yellow at the base, slightly fuscous apically. Legs nearly uniform pale brown, tibiae and tarsi

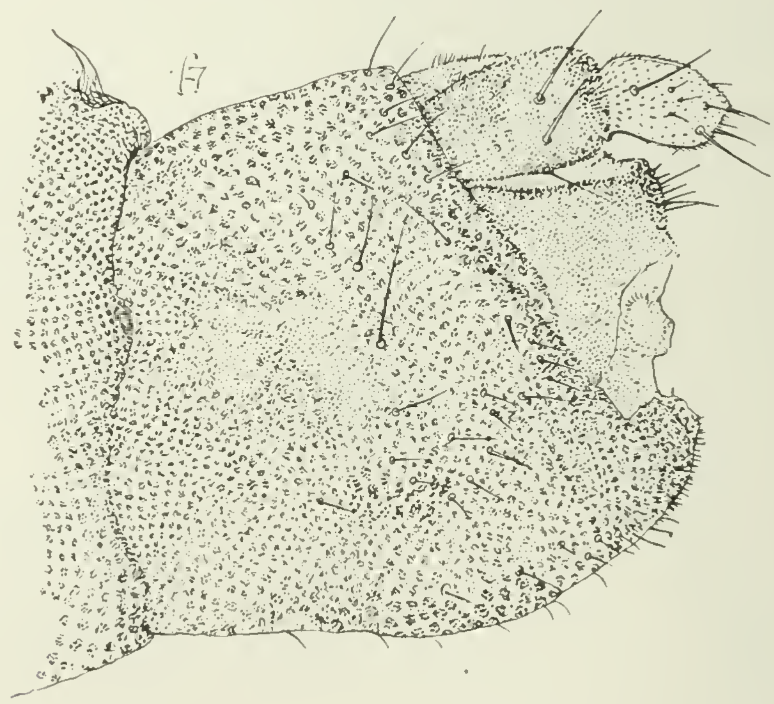


Fig. 28 P o r r i c o n d y l a b o r e a l i s; lateral view of tip of abdomen showing the ovipositor, enlarged (original)

slightly darker; claws rather stout, uniformly curved, unidentate. Ovipositor rather short, the terminal lobe suboval. Type Cecid. 155.

Porricondyla canadensis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 418

This male was secured from the Museum of Comparative Zoology through the courtesy of Samuel Henshaw and bore a blue label marked as follows: "⋕ 195, Canada, Belanger."

Male. Length 2 mm. Antennae probably nearly as long as the body, sparsely haired, fuscous yellowish, yellowish basally, at least 8 and presumably 16 segments, the fifth with a stem as long as the cylindric basal enlargement, which latter has a length about one-half greater than its diameter. Palpi presumably quadriarticulate, the fourth segment apparently twice as long as the preceding. Face yellowish. Mesonotum yellowish brown. Scutellum and postscutellum yellowish. Abdomen fuscous yellowish, sparsely haired, genitalia fuscous orange, rather thickly haired. Wings hyaline, costa pale straw. Halteres pale yellowish. Legs mostly yellowish, tibiae and tarsi pale straw, claws toothed, pulvilli one-half the length of the claws. Genitalia; roundly triangular, basal clasp segment stout, dilated apically; terminal clasp segment short, stout, broadly rounded; dorsal plate short, slightly emarginate, the lobes broadly rounded, ventral plate deeply and triangularly emarginate, the lobes diverging, narrowly rounded. Other structures indistinct. Type Cecid. 1334.

Porricondyla pini Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 144–45 (separate, p. 48)
1908 ———— N. Y. State Mus. Bul. 124, p. 418

Described from a male taken on white pine, P i n u s s t r o b u s, at Albany, N. Y., June 11, 1906.

Male. Length 1.5 mm. Antennae probably longer than the body, rather thickly clothed with coarse hairs, light brown; 16 segments, the fifth with a smooth stem one-half longer than the subcylindric basal enlargement, which latter has a length twice its diameter, the last segment with the basal enlargement fully twice the length of the preceding, subcylindric, the apex subconic. Palpi; the first segment subfusiform, with a length a little over twice its diameter, the second a little longer, stouter, the third more slender than the preceding, slightly longer, the fourth nearly twice the length of the third, more slender. Mesonotum dark brown, submedian lines with yellowish hairs. Scutellum pale orange with sparse apical setae, postscutellum a little darker. Abdomen rather dark brown, genitalia pale orange and rather thickly clothed with yellowish hairs. Wings hyaline, costa light brown. Halteres yellowish at base, whitish fuscous apically. Coxae pale orange. Legs nearly uniform pale straw; claws probably unidentate. Genitalia (Plate 6, figure 1); basal clasp segment very stout, obliquely truncate; terminal clasp segment broad at base, falciform, greatly swollen distally, the distal extremity truncate and bearing at the terminal angle a long, rather narrow appendage,

broadly rounded distally. Dorsal plate broad, narrowly and deeply incised, the lobes nearly approximate, truncate, setose; ventral plate narrow, broadly and roundly emarginate, the lobes short. Harpes long, stout, subtriangular at the base, distally apparently joined by an angulate, chitinous bar, each bearing distally two heavy, unidentate claws; style long, slender. Type Cecid. 221.

Porricondyla dilatata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 418

The male was reared Sept. 7, 1907, from a jar containing the very common Cecidomyia verrucicola O. S. gall on linden, Tilia americana, taken at Highland, N. Y. This species presumably came from debris or dead vegetable tissues.

Male. Length 1.25 mm. Antennae as long as the body, sparsely haired, yellowish brown; 16 segments, the fifth with a stem one-half longer than the ovate basal enlargement, which latter has a length one-half greater than its diameter; terminal segment reduced, narrowly oval. Palpi; first segment stout, with a length three times its diameter, the second a little longer, more slender, the third a little longer than the second, the fourth about twice the length of the third. Face fuscous yellowish. Mesonotum shining dark brown, the submedian lines sparsely haired. Scutellum fuscous orange, postscutellum fuscous yellowish. Abdomen rather thickly clothed with fuscous hairs, a variable orange yellow, membrane and pleurae pale yellowish; genitalia fuscous. Wings hyaline, costa dark brown. Halteres semitransparent basally, pale orange distally; coxae and base of femora pale yellowish, the distal portion of femora, tibiae and tarsi dark brown; claws strongly curved, unidentate, the pulvilli as long as the claws. Genitalia; basal clasp segment short, stout, terminal clasp segment short, very greatly dilated basally and tapering to a narrowly rounded apex. Harpes apparently modified into irregular, recurved hooks, other structures indistinct. Type Cecid. a1149.

Porricondyla juvenalis Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20: 239

This interesting form was taken by Mr D. B. Young at Elm Lake in the Adirondacks, New York, August 7, 1912. It is remarkable because of the greatly prolonged antennal segments and is easily separated from the allied P. flava Felt by the lancetlike, recurved harpes.

Porricondyla wellsi Felt

1915 **Felt, E. P.** Can. Ent. 47:227–28

The midge, easily distinguished by the greatly produced stems of the flagellate antennal segments and the short, greatly swollen terminal clasp segment, was taken by Mr D. B. Young at Wells, N. Y., July 5, 1914.

Porricondyla barberi Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 418

Described from a male taken at Williams, Ariz., June 6th by Mr H. S. Barber.

Male. Length 2 mm. Antennae a little longer than the body, thickly haired, yellowish; 16 segments, the fifth with a stem twice the length of the subcylindric basal enlargement, which latter has a length nearly three times its diameter; terminal segment reduced with a length nearly three times its diameter and tapering to a narrowly rounded apex. Palpi; first segment with a length about four times its diameter, the second one-half longer, more dilated, the third about one-half longer than the second, more slender and the fourth one-half longer than the third. Entire body a pale fuscous yellowish. Wings hyaline, costa pale yellowish. Halteres yellowish transparent. Legs pale yellowish; claws slender, evenly curved, unidentate, the pulvilli shorter than the claws. Genitalia; basal clasp segment stout, truncate distally; terminal clasp segment hort, greatly swollen and with a slender tooth apically. Other tructures indistinct. Type Cecid. 948.

Porricondyla hamata Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 146 (separate, p. 49–50)

1908 ———— N. Y. State Mus. Bul. 124, p. 419

This species was taken September 26, 1906 on the window of a woodland hut at Davidson's River, N. C. The same form (C. 1343) was taken August 23d by Prof. C. W. Johnson at Brookline, Mass. The wing is figured on plate 4, figure 3.

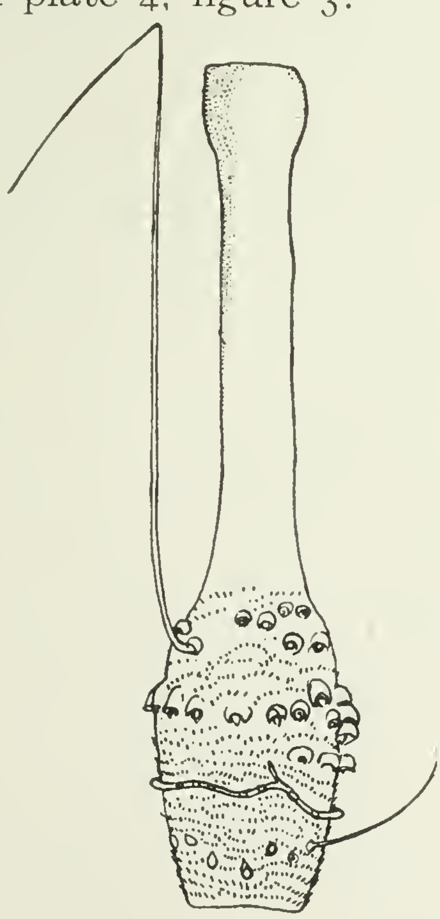


Fig. 29 P o r r i c o n d y l a h a m a t a; fifth antennal segment of male, enlarged (original)

Male. Length 3 mm. Antennae one-fourth longer than the body, sparsely clothed with long hairs, fuscous yellowish; probably 16 segments, the fifth with a stem two and one-half times the length of the cylindric enlargement. Palpi; the first, second and third segments slender, subequal, each slightly longer than its predecessor, the fourth one and one-half times longer than the third; face yellowish; the mouth parts carmine. Mesonotum dark brown, submedian lines narrow, yellowish. Scutellum pale reddish, postscutellum yellowish. Abdomen fuscous yellowish, the segments margined posteriorly with fuscous; genitalia light fuscous. Wings hyaline, costa light brown; halteres yellowish basally, fuscous apically. Legs fuscous yellowish, the last tarsal segments on the first and second pair of legs and the two distal segments on the third pair of legs, yellowish; claws probably unidentate. Genitalia; basal clasp segment broad, stout, truncate, internal angles with heavy chitinous spurs; terminal clasp segment stout, broadly expanded, truncate and with an apical triangular lobe; dorsal plate broad, deeply incised, the lobes widely separated, broadly rounded; ventral plate broadly rounded. Harpes stout, expanded, truncate, the internal angles with a pair of stout, recurved hooks; style slender, narrow and with a pair of sublateral processes at the distal third. (Plate 6, figure 2.) Type Cecid. a1626.

Porricondyla flava Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 146 (separate, p. 50)
1908 ———— N. Y. State Mus. Bul. 124, p. 419

A male was taken on red maple, Acer rubrum, at Lake Clear, N. Y., June 7, 1906.

Male. Length 1 mm. Antennae a little longer than the body, sparsely haired, dark brown; at least 12 and probably 16 segments, the fifth with a stem fully two and one-half times the length of the subcylindric basal enlargement, which latter has a length two and one-half times its diameter. Palpi; the first segment long, the basal two-thirds somewhat swollen, curved, the second about as long as the preceding, more slender, irregularly curved, the third a little shorter, stouter, slightly dilated distally, the fourth shorter than the preceding, more slender. Face pale yellowish, eyes large, black. Mesonotum pale brownish apically, yellowish posteriorly. Scutellum, postscutellum and abdomen light yellowish. Wings (Plate 4, figure 9) hyaline, costa pale straw. Halteres yellowish transparent. Legs nearly uniform pale straw; claws probably unidentate. Genitalia; basal clasp segment stout, obliquely truncate; terminal clasp segment stout, with a long, slender apical spur. Dorsal plate short, broad, broadly emarginate, the lobes obliquely truncate. Harpes broad, stout, convolute, broadly rounded; style stout, tapering. Type Cecid. 151.

CAMPTOMYIA Kieff.

1894 **Kieffer, J. J.** Soc. Ent. Fr. Ann., 63: 313, 315, 323–24
1896 ——— Berln. Ent. Zeitschr., 41: 3, 6, 26
1897 ——— Syn. Cecid. de Eur. & Alg., p. 45
1904 **Meunier, F.** Soc. Sci. Brux. Ann., 28: 8
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19: 41
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 277

Members of this genus may be separated from Porricondyla by the slender abdomen recurving dorsally, the much produced ovipositor and the strongly sinuous basal portion of the third vein.

The type of this genus, C. binotata Kieff., has at least 18 antennal segments in the male, the fifth with a stem one-half longer than the cylindric basal enlargement, the latter with a close subapical whorl of extremely long, slender setae, suggesting the crenulate whorl of Campylomyza. Palpi very long, quadriarticulate. Claws short, evenly curved, simple, the pulvilli as long as the claws. Basal portion of the third vein strongly curved, conspicuous. Genitalia triangular, the terminal clasp segment rather long, swollen near the middle, coarsely dentate apically; dorsal plate short, broad, broadly and triangularly emarginate, the lobes broadly rounded, setose; ventral plate long, incised, the lobes long, narrowly rounded, setose; style short, stout. The female has at least 28 antennal segments, the fifth with a stem one-third the length of the cylindric basal enlargement, which latter is slightly constricted near the middle, bears subapically a rather scattering whorl of long setae. The ovipositor when extended is nearly as long as the slender abdomen; terminal lobes triarticulate, the first and second segments subquadrate, the terminal one narrowly oval, tapering, setose. Cotype in the collections of the New York State Museum. Several species have been provisionally referred to this genus.

Key to species

a Stem of fifth antennal segment with a length one-fourth that of the basal enlargement, females

b Antennal segments 21, length 1.5 mm; abdomen yellowish orange aestiva Felt, C. 1400

bb Antennal segments 27, length 3.5 mm; abdomen reddish brown. Reared from hemlock........tsugae Felt, C. a2375

aa Stem of fifth antennal segment with a length one-fourth greater than its diameter, males

b Antennal segments 20, length 1.5 mm; abdomen yellowish white montana n. sp., C. 1565

bb Antennal segments 27, length 3.5 mm; abdomen reddish orange. Reared from hemlock..............................t s u g a e Felt, C. a2375

aaa Stem of fifth antennal segment with a length two and one-half times the basal enlargement, males

b Antennal segments 20, length 2.5 mm; abdomen fuscous yellowish m u l t i n o d a Felt, C. 789

Camptomyia montana n. sp.

The male described below was taken on a window at Wells, N. Y., July 5, 1914.

Male. Length 1.5 mm. Antennae a little longer than the body, sparsely haired, fuscous yellowish; 20 segments, the fifth with a stem one-fourth longer than the cylindric basal enlargement, which latter has a length one-half greater than its diameter; terminal segment produced, with a length nearly three times its diameter, slightly constricted at the basal and apical third, and tapering to an obtusely rounded apex. Palpi; the first segment irregular, quadrangular, the second with a length about three times its diameter, the third nearly twice the length of the second, the fourth three-fourths the length of the third. Body mostly yellowish or yellowish white, the legs a pale yellowish straw; claws slender, evenly curved, unidentate, the pulvilli a little shorter than the claws. Genitalia; basal clasp segment stout; terminal clasp segment moderately long, tapering at both extremities; dorsal and ventral plates indistinct in the preparation. Type Cecid. 1565.

Camptomyia aestiva Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20: 104

A female was taken by Dr W. G. Dietz at Hazelton, Pa., June 21, 1909.

Camptomyia tsugae Felt

1913 **Felt, E. P.** N. Y. Ent. Soc. Jour., 21: 214–15

Numerous specimens were reared from larval galleries of M e l a n o p h i l a f u l v o g u t t a t a Harr., in dying hemlocks in New York City.

Camptomyia multinoda Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 419 (Porricondyla)

This species was taken August 12, 1906 by Dr James G. Needham, on the door of a building at Lake Forest, Ill.

Male. Length 2.5 mm. Antennae one-fourth longer than the body, rather thickly haired, fuscous yellowish, yellowish basally;

20 segments, the fifth with a stem about two and one-half times the length of the subcylindric basal enlargement, which latter has

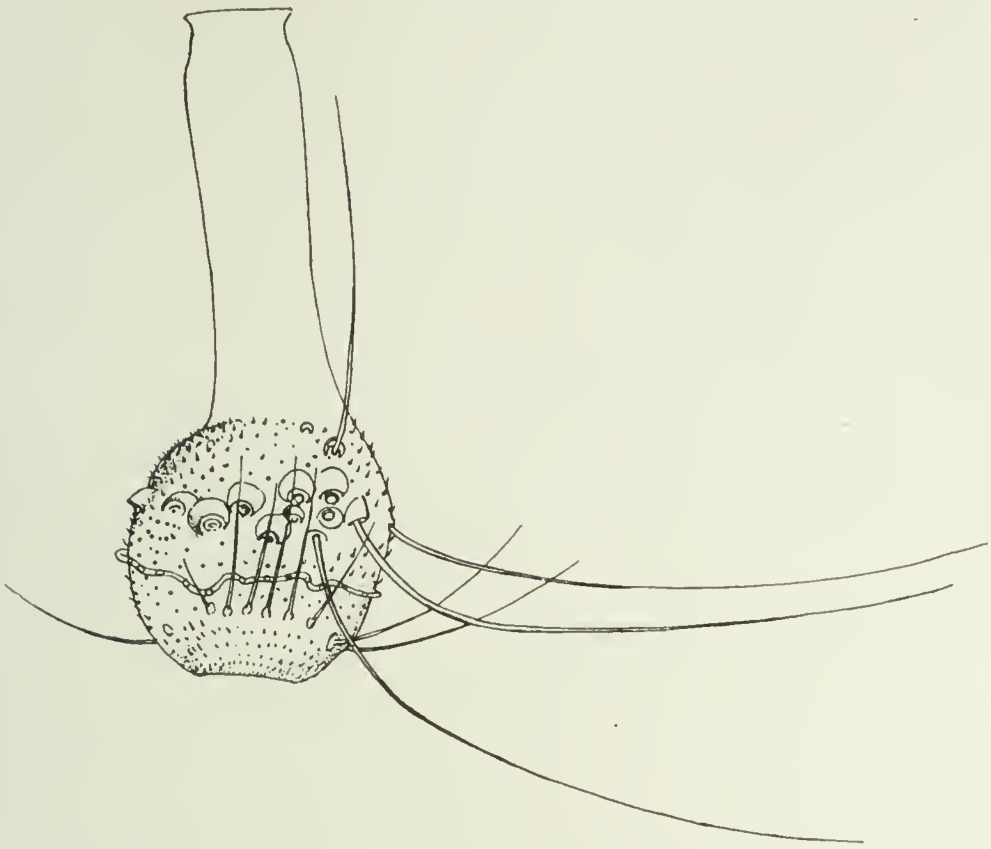


Fig. 30 Camptomyia multinoda; fifth antennal segment of male, enlarged (original)

a length one-fourth greater than its diameter, the distal two segments reduced, subfusiform. Palpi; first segment short, stout, subquadrate, the second somewhat produced, flattened, irregular and fully three times the length of the first, the third a little longer and more slender, the fourth a little shorter and stouter than the third. Mesonotum reddish brown, the submedian lines narrow, the posterior median area and scutellum yellowish, postscutellum reddish brown. Abdomen fuscous yellowish. Wings (Plate 4, figure 3) hyaline. Legs fuscous yellowish, tarsi lighter; claws slender, evenly curved, unidentate, the pulvilli a little longer. Genitalia (Plate 7, figure 4); basal clasp segment long, stout, obliquely truncate; terminal clasp segment short, stout, swollen near the middle; dorsal plate long, broad, deeply and broadly emarginate, the lobes broadly rounded; ventral plate broad, tapering, deeply and broadly emarginate, the lobes long, fingerlike; style long, slender, expanded distally. Described from alcoholic specimens. Type Cecid. 789.

DIRHIZA H. Lw.

1850 **Loew, H.** Dipt. Beitr., 4: 20, 21
1862 **Osten Sacken, C. R.** Dipt. N. Am., 1: 176
1876 **Bergenstamm, J. E. & Low, Paul.** Syn. Cecidomyidarum, p. 23
1877 **Karsch, F. A. F.** Revis. de Gallmucken, p. 16
1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3: 37, 40, 44, 115
1892 **Rubsaamen, E. H.** Berln. Ent. Zeitschr., 37: 396
1892 **Theobald, F. V.** Acct. Brit. Flies, 1: 51, 83
1894 **Kieffer, J. J.** Soc. Ent. Fr. Ann., 63: 312, 317

1896 **Kieffer, J. J.** Berln. Ent. Zeitschr., 41: 3, 26
1897 ———— Syn. Cecid. de Eur. & Alg., p. 44
1900 ———— Soc. Ent. Fr. Ann., 69: 446
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 419
1911 ———— N. Y. Ent. Soc. Jour., 19: 41
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 269

This genus is separated from Porricondyla Rond. by the antennae not being greatly prolonged in both sexes. The typical venation is illustrated on plate 4, figure 8. A number of American species having from 12 to 26 antennal segments, have been referred to this genus though, owing to the fact that we have not reared any species in this group, it is possible that some of the forms should be placed in other genera or that sexes described as distinct should belong together.

The type species, Cecidomyia lateritia H. Lw., has 14 antennal segments, the fifth of the male with a stem one-fourth the length of the cylindric basal enlargement, which latter has a length two and one-half times its diameter; low, straight circumfili occur at the middle and subapically and are united by long fili. There is a subbasal whorl of sparse setae. The palpi are very long, quadriarticulate, the terminal segment being nearly twice the length of the preceding. Subcosta unites with costa just before the basal half; the third vein, joined to the middle of subcosta by a distinct crossvein parallel with costa, unites with the margin well beyond the apex, the basal portion being nearly straight; the fifth vein joins the posterior margin at the distal fourth, its branch at the basal third, the two uniting rather indistinctly near the basal fourth. Rubsaamen, illustrating the male genitalia, represents the basal clasp segment as short, broadly oval and with the apex internally ornamented with stout, presumably chitinous tubercles and states that the terminal clasp segment is wanting.

This is based on published descriptions supplemented by studies of a balsam preparation in the Berlin Natural History Museum made by Professor Rubsaamen and labeled as being from the Loew collection.

Key to species

a 12 antennal segments
  b Fifth antennal segment with a stem one-third the length of the basal enlargement
    c Abdomen yellowish, length 1 mm; female...sylvestris Felt, C. 175
aa 13 antennal segments
  b Fifth antennal segment with a stem one-fourth the length of the basal enlargement
    c Abdomen dark brown, length 2.5 mm; female....hamata Felt, C. 142
aaa 16 antennal segments at least

b Fifth antennal segment with a stem one-fourth the length of the basal enlargement; the latter with a length three times its diameter; fourth palpal segment one-fourth longer than the third

c Abdomen yellowish, length 3 mm; female....photophila Felt, C. 45

aaaa 20 or more antennal segments

b Abdomen yellowish orange, length 3 mm; 24 antennal segments, the fifth with a stem one-fourth the length of the basal enlargement, which latter has a length three times its diameter; the fourth palpal segment one-fourth longer than the third.....................canadensis Felt, C. 952

bb Abdomen light reddish brown, length 3 mm; 25 antennal segments, the fifth with a stem one-fourth the length of the basal enlargement, which latter has a length two and one-half times its diameter; third and fourth palpal segments nearly equal...............montana Felt., C. 953

bbb Abdomen pale yellowish, length 2 mm; 26 antennal segments, the fifth with a stem one-third the length of the basal enlargement; the fourth palpal segment one-half longer than the third

multiarticulata Felt, C. 831

Dirhiza sylvestris Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 146–47 (separate, p. 50) (Porricondyla)

1908 ———— N. Y. State Mus. Bul. 124, p. 419

Described from a small, yellowish female, easily recognized by the 12 antennal segments, taken on low plants in a balsam woods, Lake Clear, N. Y., June 7, 1906.

Female. Length 1 mm. Antennae extending to the middle of the abdomen, sparsely haired, dark brown; 12 segments, the fifth with a stem one-third the length of the subcylindric basal enlargement, which latter has a length three times its diameter; terminal segment greatly produced, strongly constricted near the middle, acutely rounded distally. Palpi; the first segment prolonged, swollen distally, the second very long, irregular, the third one-half the length of the second, more slender, the fou th one-fourth longer than the third; face pale yellowish, eyes large, black. Mesonotum dark brown, submedian lines yellowish. Scutellum and postscutellum dark brown. Abdomen yellowish. Wings hyaline, costa light brown; halteres yellowish transparent basally, pale orange in the middle, the club whitish transparent. Legs pale straw; claws slender, slightly curved, unidentate. Ovipositor short, the terminal lobe ovate. Type Cecid. 175.

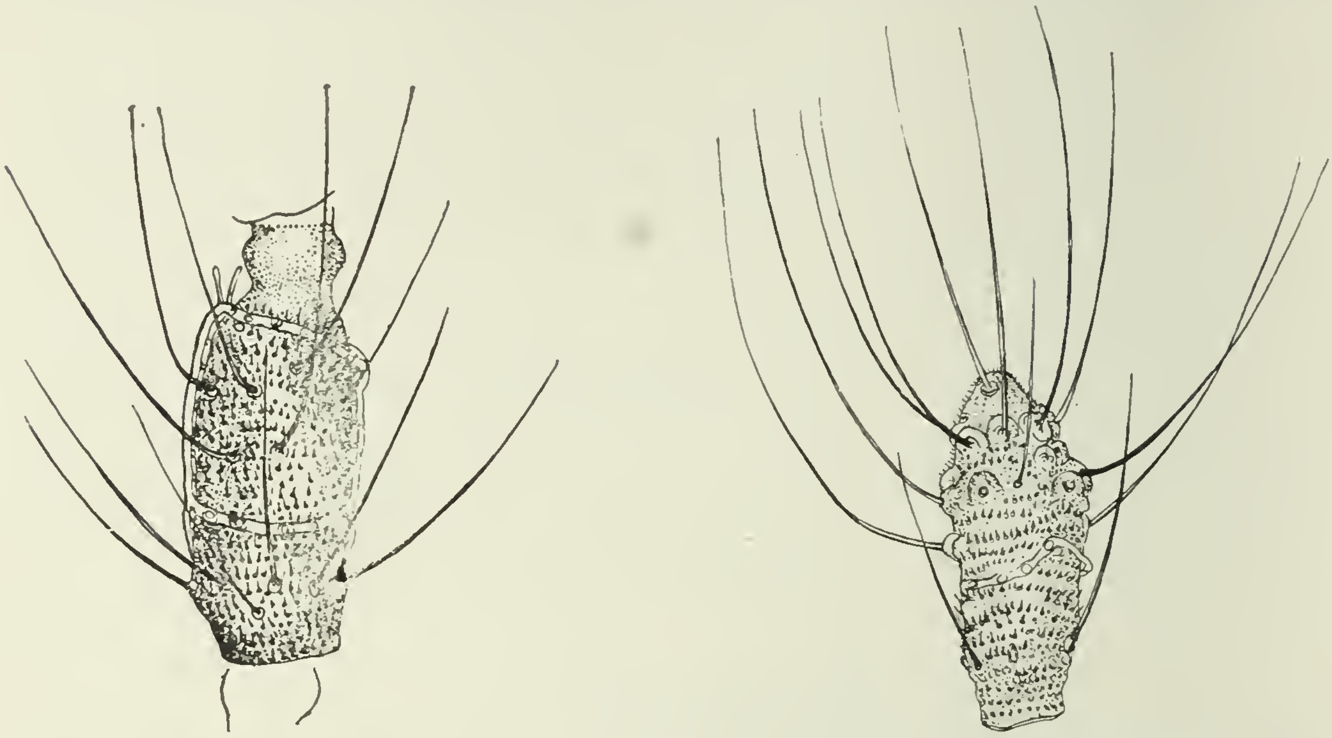
Dirhiza hamata Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 144 (separate, p. 48)

1908 ———— N. Y. State Mus. Bul. 124, p. 419

This striking form appears to be rather common though nothing is known concerning its life history. It was first taken on an office window at Albany, N. Y., June 8, 1906 and was obtained several times under similar conditions a year later. Specimens of apparently the same form were taken July 17th at Kaslo, B. C., by A. N. Caudell.

Female. Length 2.5 mm. Antennae extending to the base of the abdomen, rather thickly haired, dark reddish brown; 13 seg-



F g. 31 Dirhiza hamata; sixth and terminal antennal segments of female enlarged (original)

ments, the fifth with a stem one-fourth the length of the subcylindric basal portion, which latter has a length three times its diameter; terminal segment slightly dilated distally, the apex obtusely rounded. Palpi; the first segment stout, somewhat irregular, the second a little longer than the first, subrectangular, the third one-fourth longer than the second, more slender, the fourth nearly twice the

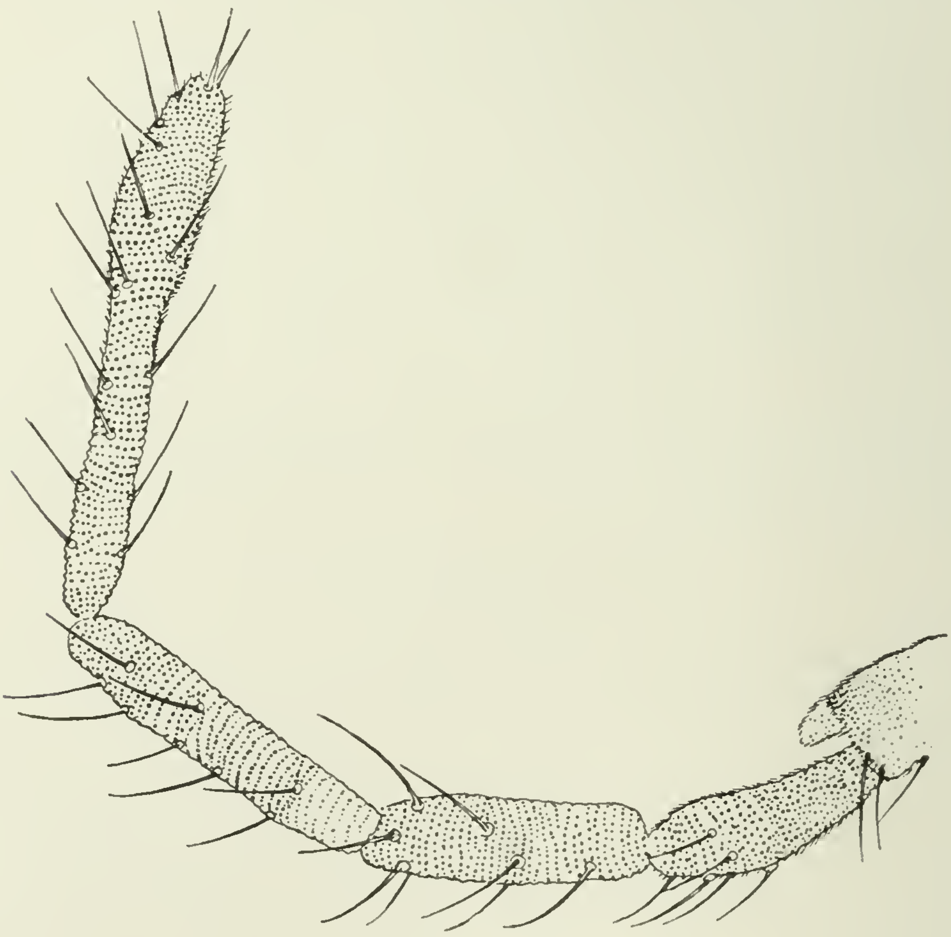


Fig. 32 Dirhiza hamata; female palpus, enlarged (original)

length of the third, more attenuate; head dark brown or black. Mesonotum black, shining, with a few scattered setae laterally. Scutellum and postscutellum dark brown. Abdomen dark brown, somewhat reddish at the sides. Wings hyaline, costa black. Legs black, tarsi with the first joint and basal four-fifths of the second dark brown, the remainder white; the third and fourth segments white, fifth slightly infuscated; claws stout, uniformly curved, simple. Ovipositor short; there are on each side, two apparently

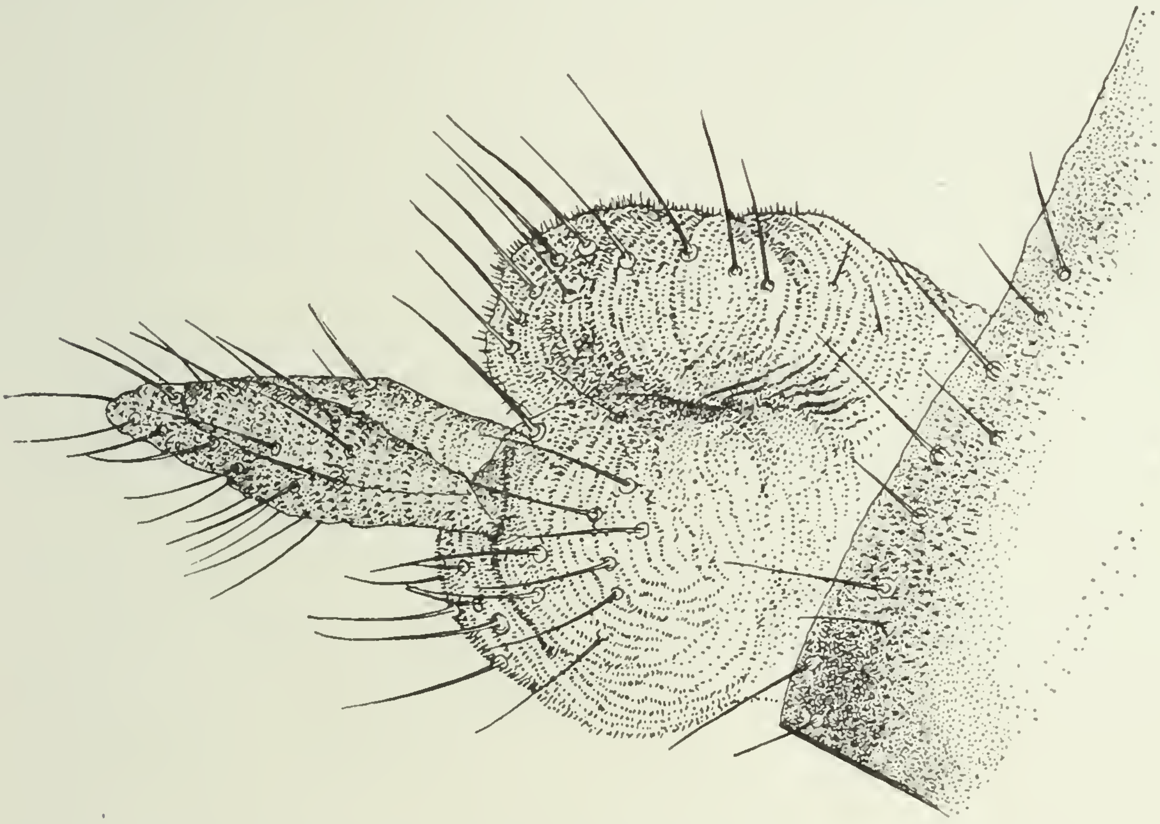


Fig. 33 Dirhiza hamata; tip of abdomen showing ovipositor, enlarged (original)

distinct plates, a dorsal and a ventral, both suboval, the dorsal pair supporting the terminal lobes, which latter are strongly constricted at the base, flattened, fusiform and thickly clothed with coarse setae.

The specimen appears to have been somewhat mutilated and has a pair of irregular, chitinous, hooklike processes (figure 34) which are probably connected with the oviducts. Type Cecid. 142.

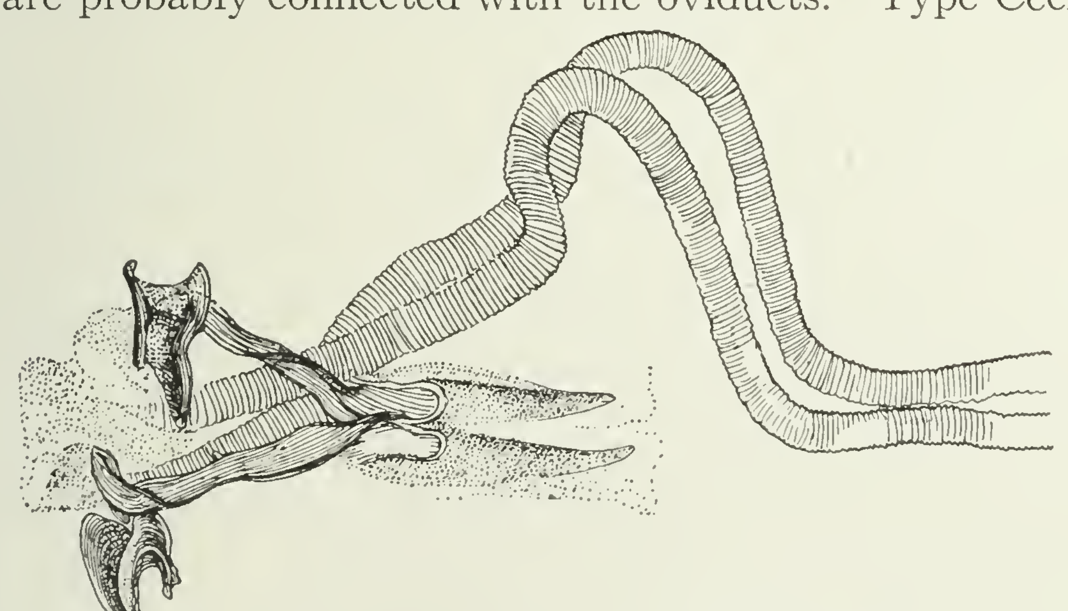


Fig. 34 Dirhiza hamata; hooks and associated structures, enlarged (original)

Dirhiza photophila Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 420

A female was taken May 17, 1906 in a trap lantern at Nassau, N. Y.

Female. Length 3 mm. Antennae shorter than the body, sparsely haired, fuscous yellow, basally yellow; at least 17 segments, the fifth with a stem one-fourth the length of the subcylindric basal enlargement, which latter has a length thrice its diameter. Palpi; the first segment short, subquadrate, slightly swollen at the distal third, the second very long, the basal third slightly narrower than the enlarged distal portion, the third a little longer than the second, more slender and the fourth one-fourth longer than the third; face yellowish. Mesonotum yellowish with median and sublateral areas brownish, submedian lines sparsely clothed with pale hairs. Scutellum and postscutellum reddish brown. Abdomen yellowish. Wings hyaline, costa light brown; halteres yellowish transparent. Legs yellowish transparent, rather thickly clothed with reddish hairs,

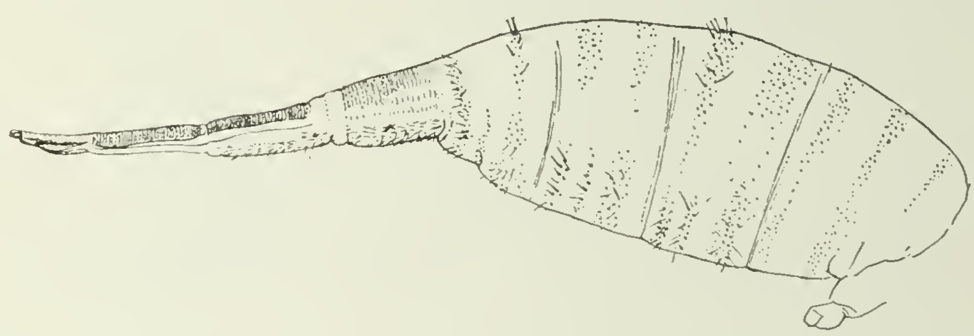


Fig. 35 Dirhiza photophila; lateral view of abdomen and ovipositor, enlarged (original)

tarsi missing; claws probably unidentate. Ovipositor two-thirds the length of the body, the terminal lobes suboval. Type Cecid. 45.

Dirhiza montana Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 420

This species, received through the courtesy of the United States National Museum, was taken in the White mountains by Morrison.

Female. Length 3 mm. Antennae extending to the fifth abdominal segment, rather thickly haired, light fuscous yellowish; 25 segments, the fifth with a stem one-fourth the length of the basal enlargement, which latter has a length two and one-half times its diameter; terminal segment produced, with a length four times its diameter and tapering to a narrowly rounded apex. Palpi; first segment stout, with a length two and one-half times its diameter, the second one-half longer, slender, the third one-fourth longer than the second, the fourth about as long as the third. Mesonotum and scutellum reddish brown, postscutellum yellowish. Abdomen light

reddish brown. Wings hyaline, costa light brown. Halteres yellowish transparent. Legs yellowish brown, the tarsi lighter. Ovipositor about half the length of the abdomen, the terminal lobe narrowly oval. Type Cecid. 953.

Dirhiza canadensis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 420

A female was captured in Canada in May 1894.

Female. Length 3 mm. Antennae nearly as long as the body, sparsely haired, pale yellowish; 24 segments, the fifth with a stem one-fourth the length of the cylindric basal enlargement, which latter has a length three times its diameter; terminal segment slightly produced and tapering from the distal fourth to a subacute apex. Palpi; the first segment rectangular, with a length three times its diameter, the second one-half longer, somewhat dilated, the third about twice the length of the second, slender, the fourth as long as the third, more slender. Mesonotum yellowish brown. Scutellum and postscutellum yellowish. Abdomen yellowish orange. Wings hyaline (Plate 4, figure 8), costa yellowish brown. Halteres yellowish transparent. Legs pale yellowish. Ovipositor indistinct in the preparation, presumably nearly as long as the abdomen. Type Cecid. 952.

Dirhiza multiarticulata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 420

The pale yellowish female was taken by Mr E. G. Love at Palisades, N. Y., in July.

Female. Length 2 mm. Antennae nearly as long as the body, very hairy, light brown, basally yellowish; 26 segments, the first obconic, the second flattened basally, subglobose, the third with the basal portion greatly produced, the fifth with a stem one-third the length of the subcylindric basal enlargement, which latter is slightly constricted near the middle and with a length three times its diameter; terminal segment prolonged, more than twice the length of the preceding, tapering to an obtuse apex, thickly setose. Palpi; the first segment prolonged, subrectangular, the second stouter, fully one-half longer, the third more slender, nearly twice the length of the preceding and the fourth more slender and one-half longer than the third. Mesonotum pale reddish orange, the submedian lines and posterior median area pale yellow. Scutellum whitish yellow, postscutellum light yellow. Abdomen pale yellow. Wings hyaline, costa pale whitish. Halteres pale yellowish white, legs a pale fuscous yellowish, distal tarsal segments slight y lighter; claws rather stout, slightly curved, simple, pulvilli as long as the claws. Ovipositor missing. Type Cecid. 831.

HOLONEURUS Kieff.

Holoneura Kieff.

1894 **Kieffer, J. J.** Soc. Ent. Fr. Ann., 63: 312, 315, 316
1895 ———— Ent. Nachr., 21: 115
1896 ———— Berln. Ent. Zeitschr., 41: 2, 3, 6, 11
1897 ———— Syn. Cecid. de Eur. & Alg., p. 43
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 420
1911 ———— N. Y. Ent. Soc. Jour., 19: 41
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 264

Species belonging to this genus are easily distinguished by the crossvein running parallel to costa and the simple fifth vein in connection with the quadriarticulate palpi, the simple claws and the small pulvilli. The type species, Holoneura cinctus Kieff., has 13 antennal segments in the male, the stem of the flagellate segments being about two-thirds the length of the basal enlargement. The female antennae are composed of 12 cylindric, subsessile segments, the fourth with a length about four times its diameter. Male genitalia thick, terminal clasp segment with a small claw, the two plates bilobed, the ventral plate shorter. Ovipositor short, the terminal lobes biarticulate. Several American species, one reared from wild fig, have been referred to this genus.

Key to species

a 12 antennal segments, the stem of the fifth as long as the basal enlargement
  b Abdomen yellowish, length 1.25 mm, female; fifth antennal segment with a stem as long as the basal enlargement.........altifilus Felt, C. 398
  bb Abdomen pale orange, length 1 mm, female; fifth antennal segment with a stem one-third the length of the basal enlargement
    humilis Felt, C. 658

aa 16 antennal segments
  b Fifth with a stem one-fourth longer than the basal enlargement, abdomen yellowish orange, length 1.5 mm. Reared from wild fig
    occidentalis Felt
  bb Fifth with a stem one-half longer than the basal enlargement, abdomen yellowish, length 1.5 mm.................tarsalis n. sp. C. a2060
  bbb Fifth with a stem twice the length of the basal enlargement; abdomen yellowish brown, length 2 mm; male.......elongatus Felt, C. 954

aaa Over 20 antennal segments, the fifth with a stem one-fourth longer than the basal enlargement
  b Abdomen dull yellowish, length 3 mm, 25 antennal segments, male
    multinodus Felt, C. 528
  bb Abdomen reddish brown, length 2 mm, 28 antennal segments, male
    photophilus Felt, C. 119

Holoneurus altifilus Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 147 (separate, p. 51) (Porricondyla)
1908 ———— N. Y. State Mus. Bul. 124, p. 420

This yellowish species was taken flying about skunk's cabbage, Symplocarpus foetidus, at Karner, N. Y., June 26, 1906.

Female. Length 1.25 mm. Antennae as long as the body, sparsely haired, fuscous; 12 segments, the fifth with a stem as long as the subcylindric basal enlargement, which latter has a length

b a

Fig. 36 Holoneurus altifilus; fifth *a*, and sixth *b*, antennal segments of female, enlarged (original)

three and one-half times its diameter, the terminal segment with the basal portion produced, the apical third constricted and the stem represented by a small, subconical appendage. Palpi; the first segment long, slightly contracted basally, the second as long as the first, stouter, the third about as long as the second, more slender, the fourth one-half longer than the third, slightly swollen distally. Head black. Mesonotum and scutellum reddish yellow, the latter with a fuscous line at the apex, postscutellum and abdomen yellowish. Wings hyaline, costa yellowish. Halteres pale, the anterior legs fuscous at the base, tarsi paler, the posterior legs pale; claws

a b

Fig. 37 Holoneurus altifilus; *a* lateral view of apex of abdomen and *b* anterior claw, enlarged (original)

stout, slightly curved, swollen near the distal fourth, unidentate. Ovipositor short, the terminal lobe suborbicular. Type Cecid. 398.

Holoneurus humilis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 417 (Johnsonomyia)

The midge was taken on low blackberry, Rubus villosus, at Albany, N. Y., July 24, 1906.

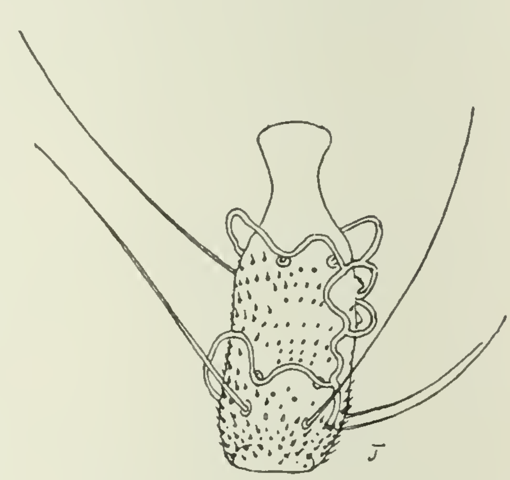


Fig. 38 Holoneurus humilis; fifth antennal segment of female, enlarged (original)

Female. Length 1 mm. Antennae shorter than the body, sparsely haired, pale brown; 12 segments, the fifth with a stem one-third the length of the cylindric basal enlargement, which latter has a length about three times its diameter; terminal segment produced, tapering to a narrowly rounded apex and with a length over four times its diameter. Palpi; the first segment greatly produced, curved, irregular, slender; the second with a length three times its diameter, the third one-half longer than the second, the fourth a little longer than the third. Mesonotum light brown, the submedian lines pale orange.

Scutellum, postscutellum and abdomen pale orange. Wings hyaline, slender, costa light brown, the third vein at the apex, the simple fifth close to the posterior margin. Halteres semitransparent, slightly fuscous apically. Legs light brown, distal tarsal segments slightly darker; claws rather long, strongly curved, slightly swollen subapically, unidentate; pulvilli rudimentary. Ovipositor short, terminal lobe narrowly oval. Type Cecid. 658.

Holoneurus occidentalis Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19: 190–91

This species was reared from a dead, partly decayed wild fig branch collected at Paraiso, Panama, by Mr E. A. Schwarz in connection with the biological survey of the isthmus under the auspices of the United States National Museum.

Holoneurus elongatus Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 420

A male, studied through the courtesy of the United States National Museum, was taken July 2d by Dr H. G. Dyar at Kaslo, B. C.

Male. Length 2 mm. Antennae one-half longer than the body; sparsely haired, light fuscous; 16 segments, the fifth with a stem twice the length of the cylindric basal enlargement, which latter has a length about two and one-half t mes its diameter, terminal

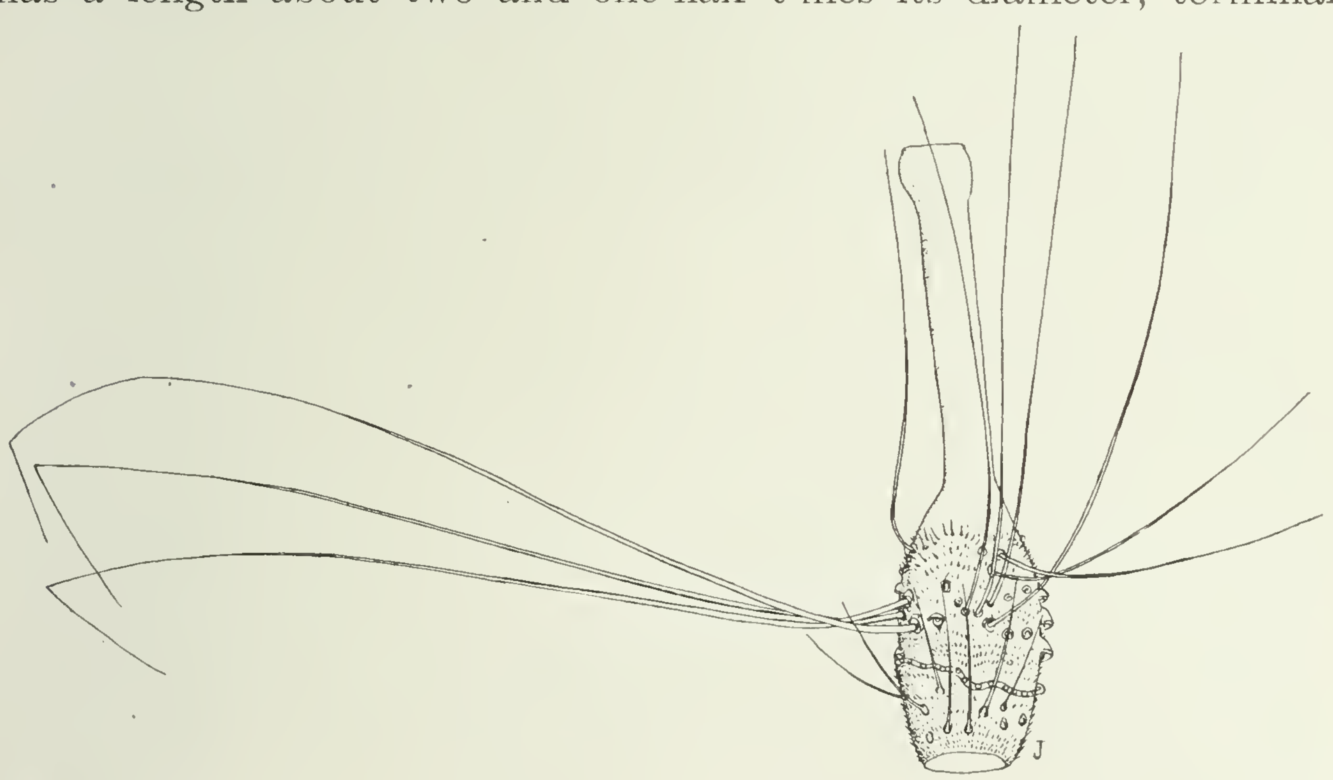


Fig. 39 Holoneurus elongatus; fifth antennal segment of male, the indistinct distal circumfilum is not represented, enlarged (original)

segment somewhat reduced, with a length three times its diameter and tapering to a narrowly rounded apex. Palpi extremely long, the first segment with a length five times its diameter, the second one-half as long as the first, the third nearly twice the length of the

second and the fourth twice as long as the third. Mesonotum reddish brown. Scutellum and abdomen light yellowish brown, the latter reddish brown apically. Wings hyaline, costa yellowish. Halteres yellowish transparent Legs fuscous yellowish, the tarsi lighter; claws long, evenly curved, unidentate, the pulvilli shorter than the claws. Genitalia; basal clasp segment short, stout; terminal clasp segment stout, greatly swollen, with a slender tooth apically; dorsal plate long, deeply and narrowly incised, the lobes narrowly rounded, ventral plate deeply and roundly emarginate, the lobes narrowly rounded. Harpes apparently modified to form slender, recurved, chitinous hooks. Type Cecid. 954.

Holoneurus tarsalis n. sp.

The yellowish male was reared August 15, 1910 from pine needles and other debris collected at the base of a large, white pine, Pinus strobus, recently defoliated by the pine sawfly, Lophyrus abbotii Leach, at North Creek, N. Y.

Male. Length 1.5 mm. Antennae one-half longer than the body, sparsely haired, fuscous brown, yellowish basally, the stems light brown; 16 segments, the fifth with a stem one-half longer than the basal enlargement, which latter has a length about twice its diameter, termina segment reduced, with a length three times its diameter, narrowly rounded apically; mouth parts deep orange. Palpi yellowish, the first and second segments presumably quadrate, the third with a length about four times its diameter, the fourth with a length nearly twice the third. Mesonotum dark brown, the submedian lines yellowish, sparsely haired. Scutellum reddish orange, postscutellum and abdomen yellowish, the latter with an orange tint basally and on the sixth and seventh segments; genitalia fuscous yellowish. Costa pale straw. Halteres yellowish basally, fuscous subapically, orange apically. Coxae pale yellowish; femora, tibiae and tarsi a nearly uniform fuscous straw, the fourth and the fifth segment basally, and the posterior tarsi mostly yellowish white. Claws long, evenly curved, unidentate, the pulvilli as long as the claws. Genitalia; basal clasp segment short, stout, obliquely truncate; terminal clasp segment short, greatly swollen, with a slender tooth apically; dorsal plate long, deeply, broadly and roundly emarginate, the lobes narrowly rounded; ventral plate long, broadly and roundly emarginate, the lobes narrowly rounded. Harpes rather long, approximate, irregularly toothed; style short, slender. Type Cecid. a2060.

Holoneurus multinodus Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 420

The midge was taken July 7, 1906 in a trap lantern at Nassau, N. Y.

Male. Length 3 mm. Antennae longer than the body, sparsely haired, fuscous yellowish, yellowish basally; 25 segments, the fifth

with a stem one-fourth longer than the cylindric basal enlargement, which latter has a length one-fourth greater than its diameter; terminal segment produced, with a length about four times its diameter and tapering to a narrowly rounded apex. Palpi short, the first segment irregularly subquadrate, the second with a length about twice its diameter, the third one-half longer, slender, the fourth a little longer than the third. Face yellowish. Mesonotum light brown, submedian lines narrow, yellow, the posterior median area yellow. Scutellum pale carmine with a few setae apically, postscutellum and abdomen a nearly uniform dull yellowish. Wings hyaline, costa light brown. Halteres yellowish transparent. Legs pale yellowish, the distal segments of the posterior tarsi slightly fuscous; claws slender, evenly curved, unidentate, the pulvilli rudimentary. Genitalia; basal clasp segment rather long, stout; terminal clasp segment short, greatly swollen, recurved; dorsal plate short, broad, broadly emarginate; ventral plate rather long, deeply and narrowly emarginate, the lobes narrowly rounded. Harpes apparently modified to form recurved, chitinous hooks. (Plate 7, figure 1). Type Cecid. 528.

Holoneurus photophilus Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 148 (separate, p. 52) (Asynapta)

1908 ———— N. Y. State Mus. Bul. 124, p. 421 (Asynapta)

One midge was taken June 3, 1906 in a trap lantern at Nassau, N. Y.

Male. Length 2 mm. Antennae one-fourth longer than the body, sparsely haired, light brown, annulate with yellow; 28 segments,

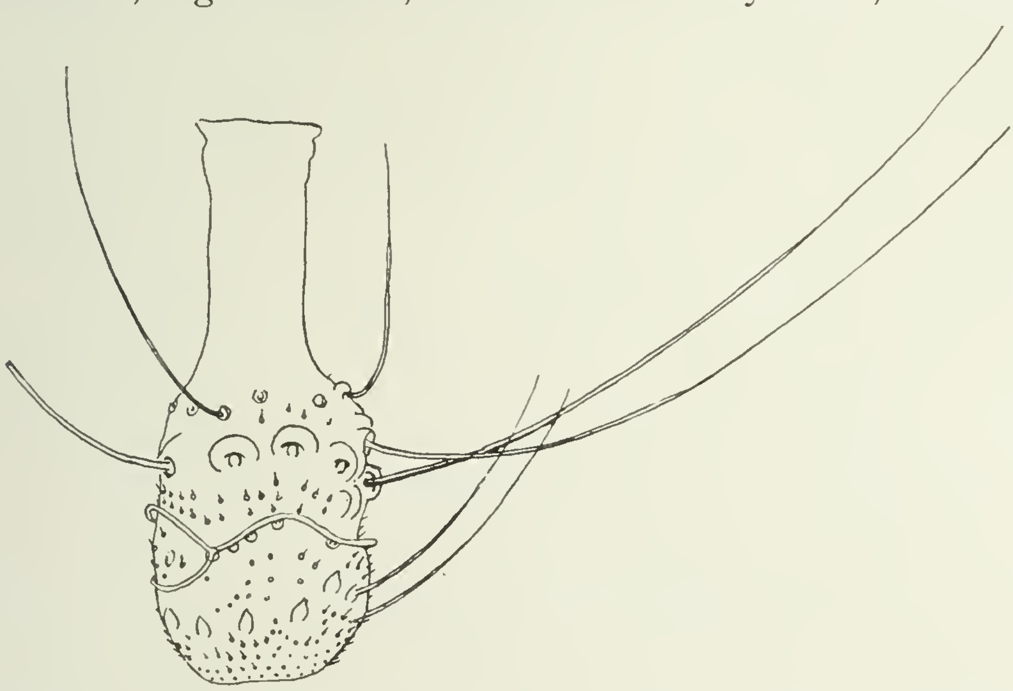


Fig. 40 Holoneurus photophilus; fifth antennal segment of male, enlarged (original)

the fifth with a smooth stem one-fourth longer than the subcylindric basal enlargement, which latter has a length twice its diameter;

terminal segment slightly prolonged, irregularly subconic, the apex narrowly rounded. Palpi; the first segment rather long, subquadrate, second much swollen at the basal third, irregular, the third nearly twice the length of the second and the fourth a little longer than the third. Face yellowish. Mesonotum reddish brown with distinct lighter submedian lines ornamented with yellowish hairs, posterior median area yellowish. Scutellum reddish brown with sparse apical hairs, postscutellum and abdomen a slightly variable reddish brown. Wings hyaline, costa pale yellowish brown. Halteres yellowish transparent basally, carmine apically. Legs long, a nearly uniform pale straw color; claws probably simple. Genitalia; basal clasp segment stout, tapering; terminal clasp segment large, strongly curved, excavated internally, with a conspicuous apical spur. Dorsal plate broad, broadly emarginate, ventral plate apparently represented by a pair of widely separated, strongly curved, truncate lobes. Harpes short, stout, strongly chitinized, fused basally, curving from the median line, distally broadly rounded and with a heavily chitinized apex; style long, slender, strongly curved. (Plate 7, figure 3). Type Cecid. 119.

OLIGOTROPHIARIAE

Members of this tribe may be distinguished by the third vein being well separated from the anterior margin, the rather short, cylindric antennal segments, usually stemmed in the male and the simple claws, or with the claws at most minutely toothed. This group comprises a large number of mostly good sized, usually reddish or reddish brown species. There is a marked tendency toward reduction in the number of palpal segments, this being particularly evident in the large genus Rhopalomyia, a natural group displaying a marked fondness for the tender tissues of leaf and flower buds. There is a great variation in the number of antennal segments, there being a range of from 12 to 26 in both Phytophaga and Rhopalomyia. Owing to variations in antennal, palpal, alar and other structures, it is very difficult to establish the genera satisfactorily. Two European genera, Mikiola Kieff. and Psectrosema Kieff., and the Brazilian Uleia Rubs. are so insufficiently described or present so little modification that we have been unable to give satisfactory diagnostic characters for their separation from American genera. The genus Mikiola Kieff. is evidently closely allied to the larger forms of Phytophaga Rond. As understood by us we are unable to find satisfactory characters for the separation of the two. It is admitted that our present grouping of species under Phytophaga, Oligotrophus and Janetiella is not entirely satisfactory, though we question the wisdom

of further revision prior to obtaining more reared material in order that both sexes may be represented by good series.

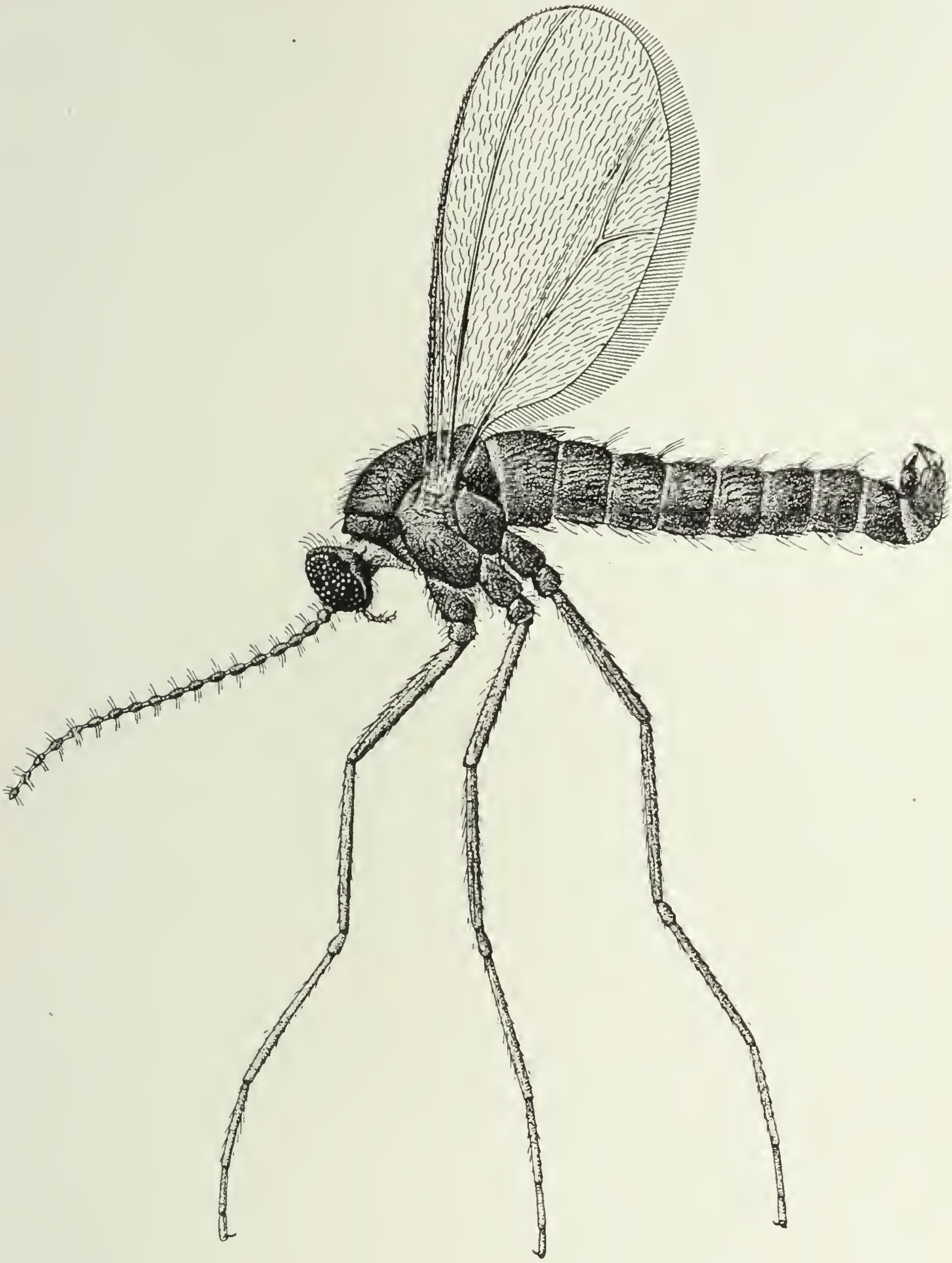


Fig. 41 Phytophaga destructor; lateral view of adult, enlarged (original)

Key to American genera

a Palpi quadriarticulate

b Third vein uniting with costa at or beyond the apex of the wing; claws simple or feebly dentate; antennal segments 11 to 20 or more Phytophaga Rond

bb Third vein uniting with costa well before the apex of the wing; antenna segments 12 to 16.............................. Janetiella Kieff

aa Palpi uni-, bi-, or triarticulate
b Ovipositor distinctly chitinized, short, the terminal portion cultriform; antennal segments 12 to 21 .... S a c k e n o m y i a Felt
bb Ovipositor fleshy, short or moderately long
c Palpi triarticulate; terminal clasp segment moderately slender; antennal segments 13 to 16 .... O l i g o t r o p h u s Latr.
cc Palpi uni- or biarticulate
d Ovipositor of the female fleshy, at least moderately long, not enlarged, the terminal lobes rather short and stout, the terminal clasp segment of the male short, stout, fusiform .... R h o p a l o m y i a Rübs.
dd Ovipositor of female short, triangular, the terminal clasp segment of the male distinctly produced, not fusiform . . W a l s h o m y i a Felt

PHYTOPHAGA Rond.

1840 **Rondani, Camillo.** Sopra alcuni nouvi generi di Insetti Ditteri. Memoria seconda per servire alla Ditterologia Italiana. Parma, Donati, p. 13
1843 ———— Sci. Nat. Bologna Ann., 9: 158–59
1846 ———— Sci. Nat. Bologna Nouv. Ann., ser. 2, p. 371, 374
1856 ———— Dipt. Ital. Prodr., 1: 200
1861 ———— Soc. Ital. Sci. Nat. Milano Atti, vol. 2, separate, p. 4
1896 **Kieffer, J. J.** Misc. Entomol. Jan., 4: 4 (Mayetiola)
1896 ———— Wien. Ent. Zeit., 15: 89 (Mayetiola)
1897 ———— Syn. Cecid. Eur. & Alg., p. 24 (Mayetiola)
1897 **Marchal, Paul.** Soc. Ent. Fr. Ann., 66: 62–63
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 369 (Mayetiola)
1910 **Rubsaamen, E. H.** Zeitschr. Wissenschaft. Insektenbiol., 15: 336
1910 ———— Zeitschr. Wissenschaft. Insektenbiol., 15: 204 (Poomyia)
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19: 45
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 86

The genus is of particular interest, since it includes the exceedingly injurious wheat pest known as the Hessian fly, P. d e s t r u c t o r Say, and treated of in most economic literature under the generic name of Cecidomyia or Mayetiola. The species referable to this genus may be recognized by the third vein uniting with costa at or beyond the apex, in connection with the quadriarticulate palpi and the simple or feebly dentate claws. We have provisionally allowed this genus to remain in the Oligotrophiariae, a tribe characterized in part by simple claws.

The genus Phytophaga was erected by Rondani in 1840, in a paper, which according to information kindly supplied by Dr Mario Bezzi of Italy, was published separately. There was no designation of a type species until 1856, when Rondani cites P h y t o p h a g a c e r e a l i s Rond., this being a synonym of P. d e s t r u c t o r Say.

Key to species

a 11 to 15 antennal segments

b 11 antennal segments

c Abdomen and the antennae with its sessile segments fuscous yellowish
caudata n. sp., C. 1381

b 12 antennal segments

c Abdomen yellowish; antennae light brown, the segments subsessile, the second and third tarsal segments more or less dilated; male
azaleae Felt, C. 48

bb 13 sessile or subsessile antennal segments

c Abdomen and antennae dark brown; male.........aceris Felt, C. 66a

cc Abdomen reddish brown, the fifth antennal segment with a length one-half greater than its diameter; ovipositor one-fourth the length of the body; female.........................virginiana Felt, C. 80

ccc Abdomen reddish brown, the fifth antennal segment with a length twice its diameter; ovipositor as long as the body; female
balsamifera Felt, C. 146

bbb 14 antennal segments

c Posterior tarsi normal

d Antennal segments sessile

e Abdomen reddish brown, the fifth antennal segment with a length twice its diameter, the fourth palpal segment one-half longer than the third; ovipositor one-fifth the length of the abdomen
electra Felt, C. 50b

ee Abdomen bright red, the fifth antennal segment with a length two and one-half times its diameter, the fourth palpal segment a little longer than the third; ovipositor as long as the body, female; reared from elm buds and folded leaves
ulmi Beutm., C. 1239, a1683

dd Antennal segments subsessile, the fifth with a stem one-fourth or one-third the length of the basal enlargement

e Third vein uniting with costa well beyond the apex

f Abdomen pale yellowish, the fifth antennal segment with a stem one-fourth the length of the basal enlargement; male
thalictri Felt, C. 98

ee Third vein uniting with costa just beyond the apex

f Abdomen bright red; ovipositor short; female
socialis Felt, C. 97

ff Abdomen yellowish or fuscous yellowish; ventral plate of the male deeply and roundly emarginate distally; the female with the ovipositor as long as the body; reared from rolled violet leaves
violicola Coq., C. a1346

fff Abdomen yellowish; ventral plate of the male deeply and triangularly incised; female with ovipositor as long as the body; reared from ash leaves.................fraxini n. sp., C. a1841

ddd Antennal segments plainly stemmed, the fifth with a stem as long as the basal enlargement

e Abdomen reddish orange; ventral plate broadly and roundly emarginate; reared from partly folded elm leaves....ulmi Beutm., a1683

cc Second to fourth segments of the posterior tarsi greatly enlarged; abdomen pale yellowish, greenish dorsally; third vein uniting with costa just beyond the apex; antennae dark brown, the fifth segment with a stem one-half the length of the basal enlargement; male
latipes Felt, C. 511

bbbb 15 antennal segments

c Abdomen dark reddish; antennae dark reddish brown, the fifth segment with a stem one-fourth the length of the basal enlargement; male; reared from spruce bud gall.................tsugae Felt, C. 165

cc Abdomen yellowish brown; fifth antennal segment with a length two and one-half times its diameter............latipennis Felt, C. 782

aa 16 to 19 antennal segments

b 16 antennal segments

c Antennal segments sessile, the fifth with a length two and one-half times its diameter; ovipositor one-half the length of the abdomen

d Abdomen reddish brown, the body slender, the lobes of the ovipositor with a length twice their width; reared from slender willow twigs; female..........................caulicola Felt, C. a1822a

dd Abdomen dark brown, the body stout, the lobes of the ovipositor with a length three and one-half times their width; reared from subglobose galls on slender willow twigs...tumidosae Felt, C. 1300

cc Antennal segments with more or less of a stem

d Fifth antennal segment with a stem one-fourth the length of the basal enlargement, which latter has a length twice its diameter; abdomen yellowish brown; third and fourth palpal segments equal; reared from Ribes; female.................californica Felt, C. 919

dd Fifth antennal segment with a stem one-third the length of the basal enlargement; abdomen dark brown; reared from slender willow twigs; male.........................caulicola Felt, a1822a

ddd Fifth antennal segment with a stem one-half the length of the basal enlargement; abdomen yellowish brown; reared from Ribes; male..........................californica Felt, C. 919

dddd Fifth antennal segment with a stem three-fourths the length of the basal enlargement; abdomen yellowish brown; reared from willow..........................latipennis Felt, C. 782

bb 17 antennal segments

c Fifth antennal segment with a stem three-fourths the length of the basal enlargement; abdomen dark brown; reared from willow; male
americana Felt, C. 920

bbb 18 antennal segments

c Fifth antennal segment with a stem three-fourths the length of the basal enlargement

d Abdomen reddish brown; reared from wheat stems; male
destructor Say, C. 771, 772

bbbb 19 antennal segments

c Abdomen reddish brown; fifth antennal segment with a length three times its diameter; ovipositor one-fourth the length of the abdomen, the lobe with a length twice its width; reared from wheat stems; female
destructor Say, C. 771

cc Abdomen dark brown; fifth antennal segment with a length one-half greater than its diameter; ovipositor one-half the length of the abdomen, the lobe with a length three times its width; reared from willow; female................................a m e r i c a n a Felt, C. 920

aaa 20 or more antennal segments

b Antennal segments sessile

c Abdomen reddish; 24 to 26 antennal segments, the fifth with a length one-half greater than its diameter; the ovipositor one-fourth the length of the abdomen, the lobe with a length one-half greater than its width; reared from apical beak gall on willow; female. . r i g i d a e O. S., C. a687

cc Abdomen light brown; 26 antennal segments, the fifth with a length two and one-half times its diameter; the ovipositor one-third the length of the abdomen, the lobes with a length only three-fourths the width; reared from a small clustered rosette willow gall; female w a l s h i i Felt, C. 774, 924, a1813

ccc Abdomen reddish brown; 24 antennal segments, the fifth with a length two and one-half times its diameter; the ovipositor as long as the body, the lobe with a length four times its width; reared from Celtis leaves; female........................c e l t i p h y l l i a Felt, C. 913, 918

bb Antennal segments with a distinct stem

c Fifth antennal segment with a stem one-half the length of the basal enlargement

d Abdomen reddish brown; 24 antennal segments; reared from a beak gall on willow; male..........................r i g i d a e O. S., C. a687

cc Fifth antennal segment with a stem three-fourths the length of the basal enlargement

d Abdomen dark brown; 20 antennal segments; reared from Salix stems; male..............................p e r o c c u l t a Ckll., C. 1251

dd Abdomen pale yellowish; 25 to 26 antennal segments; reared from a small clustered rosette willow gall; male....w a l s h i i Felt, C. 774

ccc Fifth antennal segment with a stem as long as the basal enlargement

d Abdomen reddish brown; 22 to 23 antennal segments; reared from Celtis leaves; male............c e l t i p h y l l i a Felt, C. 913, 918

Phytophaga caudata n. sp.

The fuscous yellowish species described below was taken at Albany, N. Y., May 9, 1910 on wild geranium, G e r a n i u m m a c u l a t u m. The insects appeared to be pairing, though males only were secured. Nothing is known concerning the life history of this form.

Male. Length 1.5 mm. Antennae hardly extending to the base of the abdomen, sparsely haired, fuscous yellowish, the distal segment variably tinted with reddish; 11 sessile segments, the fifth with a length about one-third greater than its diameter; distal s gment produced, with a length over twice its diameter, narrowly rounded apically. Palpi; first segment irregularly ovoid, the second narrowly oval, with a length about twice its width, the third one-half longer than the second, somewhat dilated, the fourth as long as the second, more slender. Mesonotum dark brown, the sub-

median lines sparsely haired Scutellum reddish brown; postscutellum yellowish. Abdomen sparsely haired, fuscous yellowish; genitalia yellowish, fuscous apically. Wings narrow, costa pale straw, the third vein uniting therewith at the apex. Halteres yellowish basally, a variable reddish apically. Coxae reddish brown. Legs a variable fuscous yellowish, the distal tarsal segments reddish brown; claws moderately stout, evenly curved, the pulvilli as long as the c aws. Genitalia; basal clasp segment short, stout, terminal clasp segment short, tapering; dorsal plate short, deeply and triangularly emarginate, ventral plate moderately long, broad, broadly rounded. Type Cecid. 1381.

Phytophaga azaleae Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 122 (separate, p. 26) (Oligotrophus)

1908 ——— N. Y. State Mus. Bul. 124, p. 369 (Mayetiola)

The yellowish midge was taken on azalea at Albany, N. Y., May 18, 1906.

Male. Length 1.5 mm. Antennae not extending to the base of he abdomen, sparsely haired, light brown; 12 segments, the fifth and following subsessile, slightly swollen near the middle; terminal segment short, reduced, subovoid. Palpi; the first segment short, stout, broadly rounded, the second a little longer, similar, the third and fourth each slender and about twice the length of the second; face dark brown. Mesonotum dark brown with submedian lines of dark hairs. Scutellum reddish brown, postscutellum lighter, abdomen yellowish, genitalia dark brown. Wings hyaline, costa tinged with red, the third vein just beyond the apex. Halteres and coxae yellowish transparent. Femora and tibiae yellowish brown, tarsi brown, tinged with reddish, the second and third tarsal segments dilated; claws stout, slightly curved. Genitalia; basal clasp segment short, stout; terminal clasp segment short, broad at base; dorsal plate short broad, deeply emarginate; ventral plate broad, rounded, tapering, broadly emarginate. Type Cecid. 48.

Phytophaga aceris Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 122 (separate, p. 26) (Oligotrophus)

1908 ——— N. Y. State Mus. Bul. 124, p. 369 (Mayetiola)

The dark brown male was taken at Albany, N. Y., on red maple, Acer rubrum, May 21, 1906.

Male. Length .75 mm. Antennae extending to the third abdominal segment, sparsely haired, dark brown; 13 sessile segments; terminal segment nearly double the length of the preceding, broadly rounded. Palpi; the first segment stout, the second one-half longer than the first, the third a little longer, more slender, the fourth

one-half longer than the third; face dark brown. Mesonotum dark brown with distinct submedian lines of yellowish hairs. Scutellum reddish brown, postscutellum yellowish. Abdomen dark brown, sparsely clothed with yellowish hairs. Wings hyaline, costa dark brown, the third vein a little before the apex. Halteres yellowish transparent. Legs reddish brown and yellowish, lighter ventrally, the femora apically, the tibiae and the distal tarsal segments darker; claws slender, uniformly curved. Genitalia; basal clasp segment stout, with a conspicuous fingerlike, slightly curved process arising from the basal third; terminal clasp segment swollen; dorsal plate broad, deeply and triangularly incised Harpes slender, convolute, broadly rounded. Type Cecid. 66a.

Phytophaga balsamifera Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 369 (Mayetiola)

This reddish brown female was taken on balsam, A b i e s b a l s a m i f e r a, at Lake Clear, N. Y., June 7, 1906.

Female. Length 1.5 mm. Antennae extending to the third abdominal segment, sparsely haired, dark brown; 13 sessile segments, the fifth with a length twice its diameter terminal segment nearly double the length of the preceding, broadly rounded. Palpi; the first segment suboval, the second about as long as the first, the third a little shorter, broader, the fourth a little shorter, broadly oval; face reddish brown. Mesonotum nearly uniform dark brown. Scutellum reddish brown. Abdomen rather bright red. Wings hyaline, costa dark brown, the third vein a little before the apex. Halteres yellowish red basally, the base of the club fuscous, the tip yellowish white. Legs nearly uniform straw brown, the articulations tinged with carmine; claws stout, uniformly curved. Ovipositor as long as the body, terminal lobes long, slender, narrowly rounded. Type Cecid. 146.

Phytophaga virginiana Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 369 (Mayetiola)

The reddish brown female was taken on choke cherry, P r u n u s v i r g i n i a n a, at Albany, N. Y., May 23, 1906.

Female. Length 2 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown; 13 sessile segments, the fifth with a length one-half greater than its diameter; terminal segment much produced, more than twice the length of the preceding, slightly constricted at the basal third. Palpi; the first and second segments short, suboval, the third more slender, nearly twice the length of the preceding two, the fourth a little longer than the third. Mesonotum reddish brown, darker anteriorly, shining. Scutellum and postcutellum light reddish brown. Abdomen reddish brown, thinly clothed with hairs. Wings hyaline, costa light straw, the third vein just beyond the apex. Halteres

brownish. Legs pale at base, gradually darkening distally, tarsi light brown; claws slender, uniformly curved. Ovipositor short, about one-fourth the length of the body, terminal lobes short, stout, broadly rounded. Type Cecid. 80.

Phytophaga ulmi Beutm.

1907 **Beutenmueller, William.** Amer. Mus. Nat. Hist. Bul. 23, p. 387 (Cecidomyia)

1908 **Jarvis, T. D.** Ent. Soc. Ont. 38th Rep't, p. 86 (Cecidomyia)

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 369 (Mayetiola)

1909 **Jarvis, T. D.** Ent. Soc. Ont. 39th Rep't, p. 80 (Cecidomyia)

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20:240 (Male)

This bright-red species was reared from small terminal leaves or leaf buds of the American elm, Ulmus americana. It occurs about New York City, probably at Albany, N. Y., and has been reported by Jarvis as fairly common in Ontario, Canada.

Gall. This is produced by the folding and growing together of small, immature, terminal leaves or leaf buds, the adults appearing in June and July.

Female. Length 1.5 mm. Antennae extending to the third abdominal segment, sparsely haired, pale yellowish; 14 subsessile segments, the fifth with a length about two and one-half times its diameter, tapering; terminal segment produced, narrowly oval, more or less fused with the preceding. Palpi; the first segment rather long, irregularly oval, the second short, stout, broadly oval, the third nearly twice the length of the second, more slender, the fourth a little longer and more slender than the third; face yellowish brown. Mesonotum light shining brown, the submedian lines sparsely haired. Scutellum yellowish brown, postscutellum fuscous yellowish. Abdomen very sparsely haired, light fuscous yellowish (in life bright red); terminal segment a little darker, the distal portion of the ovipositor pale yellowish. Wings hyaline, costa dark brown, the third vein just before the apex. Halteres yellowish basally, slightly fuscous apically. Coxae and base of femora pale yellowish, the femora distally and tibiae basally a variable brown or yellowish brown, the distal portion of tibiae and tarsi dark brown; claws long, slender, evenly curved; pulvilli shorter than the claws. Ovipositor about as long as the body, the terminal lobes short, broad, broadly rounded.

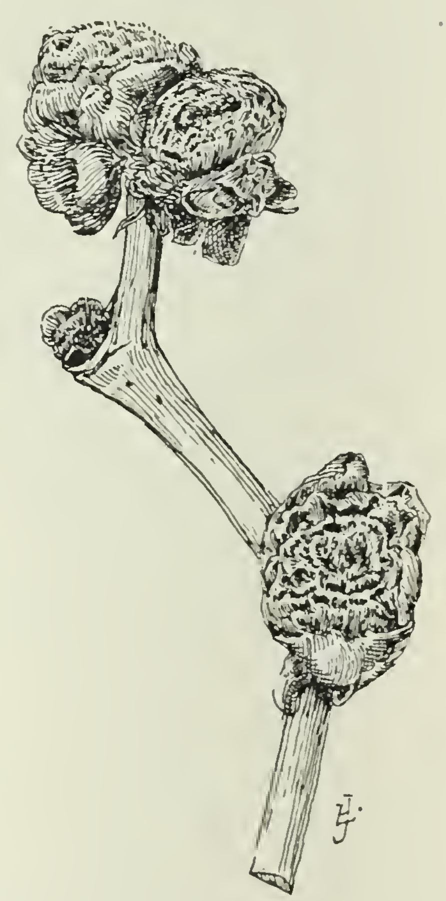


Fig. 42 Phytophaga ulmi; gall nearly natural size (original)

Described from a type specimen, Cecid. 1239, donated for study by Prof. William Beutenmueller.

Phytophaga electra Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 369 (Mayetiola)

This reddish brown species was taken on hazel, Corylus americana, at Albany, N. Y., May 18, 1906.

Female. Length 1.5 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown; 14 sessile segments, the fifth with a length twice its diameter; terminal segment somewhat produced, fusiform. Palpi; the first segment quadrate, the second a little longer than the first, tapering slightly distally, the third one-fourth longer than the second, slightly swollen at the distal fourth, the fourth one-third longer than the third, slightly swollen distally. Mesonotum dark brown, the submedian lines and posterior median area yellowish. Scutellum yellowish with numerous apical yellowish setae, postscutellum dark brown. Abdomen carmine red. Wings hyaline, costa reddish brown, the third vein well beyond the apex. Halteres and coxae yellowish transparent; femora and tibiae yellowish brown, tarsi darker; claws slender, strongly curved. Ovipositor short, the terminal lobes stout, broadly rounded. Type Cecid. 50b.

Phytophaga thalictri Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 123 (separate, p. 27) (Oligotrophus)

1908 ———— N. Y. State Mus. Bul. 124, p. 369 (Mayetiola)

This pale yellowish form was taken on early meadow rue, Thalictrum dioicum, at Albany, N. Y., June 1, 1906.

Male. Length 1.5 mm. Antennae shorter than the body, sparsely haired, light brown, yellowish basally; 14 segments, the fifth with a stem one-fourth the length of the basal enlargement, which latter has a length two and one-half times its diameter; terminal segment stout, rounded, subconical apically. Palpi; first segment short, stout, swollen distally, the second irregularly quadrate, short, the third nearly twice the length of the second, obliquely truncate, the fourth more slender, a little longer than the third. Mesonotum light yellowish brown, the submedian lines paler. Scutellum, postscutellum and abdomen pale yellowish, the latter sparsely clothed with light hairs. Wings hyaline, costa light brown, the third vein beyond the apex. (Plate 17, figure 6). Halteres pale yellowish transparent. Coxae and basal portion of femora pale yellowish, the remainder of legs fuscous yellow; claws long, slender, evenly curved. Genitalia; basal clasp segment stout, obliquely

truncate; terminal clasp segment stout; dorsal plate short, broad, deeply incised; ventral plate deeply and triangularly emarginate. Type Cecid. 98.

Phytophaga socialis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 369 (Mayetiola)

This bright reddish species was taken on early meadow rue, Thalictrum dioicum, at Albany, N. Y., June 1, 1906.

Female. Length 1 mm. Antennae shorter than the body, sparsely haired, dark brown, yellowish basally; 14 segments, the fifth with a stem one-third the length of the basal enlargement, which latter has a length twice its diameter; terminal segment subcylindric. Palpi; the second segment prolonged, slender, the third and fourth subequal, one-third longer than the second. Face yellowish. Mesonotum dark brown. Scutellum reddish brown, postscutellum lighter. Abdomen bright reddish. Wings hyaline, costa light brown, the third vein well beyond the apex. Halteres yellowish transparent. Legs nearly uniform pale brown; tarsi a little darker; claws slender, uniformly curved. Ovipositor short, the terminal lobes broad at base, tapering, broadly rounded. Type Cecid. 97.

Phytophaga violicola Coq.

Violet gall midge

1899 **Coquillett, D. W.** U. S. Dep't Agric., Div. Ent. Bul. 22, n.s. p. 48–51 (Diplosis)
1901 **Chittenden, F. H.** U. S. Dep't Agric., Div. Ent. Bul. 27, n.s. p. 47–50 (Diplosis)
1904 **Washburn, F. L.** Minn. Agric. Exp't Sta. Bul. 88, p. 189–90 (Diplosis)
1905 **Washburn, F. L.** Minn. Agric. Exp't Sta. Bul. 93, p. 65 (Diplosis)
1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 59–61 (Contarinia)
1907 ———— U. S. Dep't Agric., Bur. Ent. Bul. 67, p. 41–42 (Contarinia)
1908 ———— N. Y. State Mus. Bul. 124, p. 369 (Mayetiola)
1909 ———— Ent. Soc. Ont. 39th Rep't, p. 43 (Contarinia)

This small, yellowish species is a serious pest in some violet houses, reducing the crop from one-third to one-half and causing a considerable loss in the aggregate. It is a local species, since one-half of a house 150 feet long may be seriously injured, while the other portion is almost exempt. The midges very rarely leave the plants and can be discovered only by flushing them with the hand. In infested houses none were to be found on the windows, in cobwebs or even in sheds at the ends of the houses. The first signs of injury are seen in the curling of the young violet leaves, caused by the yellowish maggots. This may be so rapid that leaves perfectly straight one day may be badly curled the next.

Larva. Length 2 mm, pale yellowish, rather slender. Head small, antennae long, tapering; breastbone bidentate, the shaft slender. Skin smooth; posterior extremity broadly rounded.

Male. Length 1.5 mm. Antennae extending to the fourth abdominal segment, sparsely haired, fuscous yellowish or dark brown, fourteen segments, the fifth with a stem about one-third the length of the basal enlargement, which latter has a length twice its diameter; terminal segment with the enlarged part produced, tapering, obtuse. Palpi; the first segment slightly subglobose, the second greatly enlarged, pyriform, the third slender, one-half longer than the second, slightly swollen at the basal third, the fourth one-half longer than the third, more slender. Face and mouth-parts fuscous yellowish. Mesonotum dark brown, almost black, the submedian lines sparsely clothed with yellowish setae. Scutellum fuscous yellowish, postscutellum dark brown mesially. Abdomen yellowish or fuscous yellowish, the segments margined posteriorly with fuscous in darker individuals. Wings hyaline, costa dark brown, the third vein beyond the apex, (Plate 17, figure 5) halteres yellowish transparent; coxae, femora and tibiae mostly dark brown, tarsi a variable fuscous yellow. Claws long, slender, evenly curved. Genitalia; basal clasp segment short, stout; terminal clasp segment short, stout; dorsal plate short, broad, broadly and triangularly emarginate; ventral plate short, broad, deeply and roundly emarginate.

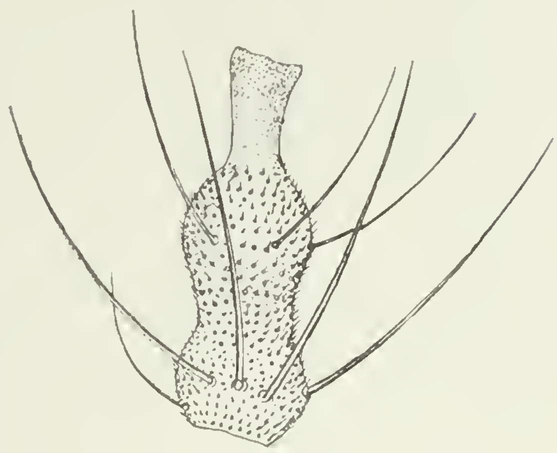


Fig. 43 Phytophaga violicola; sixth antennal segment of male, enlarged (original)

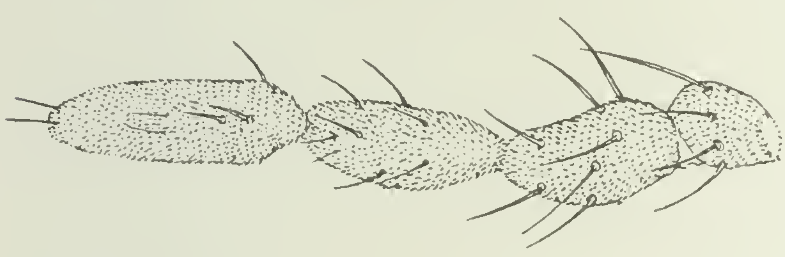


Fig. 44 Phytophaga violicola; male palpus, enlarged (original)

Female. Length 2 mm. Antennae extending to the fourth abdominal segment, sparsely haired, fuscous yellowish, fourteen segments, the fifth with a stem one-third the length of the basal enlargement; terminal segment hardly produced, obtusely rounded. Palpi; the first segment short, stout, subquadrate, the second one-half longer, somewhat enlarged, slightly swollen at the basal third, the third rather long, slender, slightly rounded, the fourth a little longer, somewhat flattened. Face and mouth-parts fuscous. Color characters about as in the opposite sex. Ovipositor a pale salmon, probably longer than the body, the terminal lobes long, slender, acutely rounded.

Phytophaga fraxini n. sp.

This yellowish midge was reared June 22d from the leaf petioles of ash, Fraxinus, taken at Poughkeepsie, N. Y., June 9, 1908. Infested shoots were collected at Albany, N. Y., June 13, 1913.

Gall. Numerous pale yellowish larvae were observed at the base of the terminal leaf petioles. They prevent the normal development of the central, leading bud. There was no noticeable deformity.

Larva. Length 1.5 mm, pale yellowish. Head long, slender; antennae rather short, tapering; breastbone bidentate, teeth broadly rounded, the shaft rather slender. Skin finely shagreened; posterior extremity broadly rounded.

Male. Length 2 mm. Antennae nearly as long as the body, sparsely haired, fuscous yellowish, the basal segments yellowish; 14 segments, the fifth with a stem about one-fourth the length of the basal enlargement, which latter has a length about three and one-third times its diameter; terminal segment rather stout, with a length about three times its diameter and bearing apically a rather long, stout, fingerlike process. Palpi; the first segment short, stout, subquadrate, the second with a length about three times its diameter, the third a little longer and more dilated and the fourth as long as the third. Face yellowish. Mesonotum light brown, the submedian lines yellowish, sparsely haired. Scutellum yellowish orange, postscutellum, abdomen and genitalia yellowish. Wings hyaline, costa light brown, the third vein well beyond the apex; halteres yellowish transparent. Coxae and femora basally yellowish, the distal portion of femora and tibiae light fuscous yellowish, tarsi mostly dark brown; claws long, slender, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment short, stout; dorsal plate short, stout, deeply and triangularly emarginate; ventral plate long, deeply and triangularly incised.

Female. Length 2.5 mm. Antennae extending to the fourth abdominal segment, sparsely haired, fuscous yellowish, basally yellowish; 14 segments, the fifth with a stem one-fourth the length of the basal enlargement, which latter has a length three times its diameter; terminal segment produced, with a length five times its diameter, apically a pyriform appendage. Palpi; the first segment short, stout, subquadrate, the second rather stout, with a length nearly three times its diameter, the third one-half longer than the second, more slender and the fourth one-half longer than the third, more dilated. Color practically as in the male, except that the mesonotum is slightly darker and the setae on the abdomen more evident. The wings are slightly more hairy. Legs and claws practically as in the opposite sex. Ovipositor about as long as the body, slender, the terminal lobes long, tapering, narrowly rounded. Type Cecid. a1841.

Phytophaga tsugae Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 123 (separate, p. 27) (Mayetiola)

1908 ———— N. Y. State Mus. Bul. 124, p. 370 (Mayetiola)

This dark reddish male was taken on hemlock, T s u g a c a n a d e n s i s, at Lake Clear, N. Y., June 7, 1906. The adult was reared from spruce bud galls by J. M. Swaine from material collected near Ottawa, Que., in 1914.

Male. Length 1.5 mm. Antennae extending to the middle of the abdomen, thickly haired, dark reddish brown; 15 segments, the fifth with a stem one-fourth the length of the basal enlargement, which latter has a length one-half greater than its diameter; terminal segment slightly prolonged, subfusiform. Palpi; the first segment irregular, swollen distally, the second subpyriform, the third broadly oval, the fourth one-half longer than the third, subcylindric, broadly rounded apically; face dark reddish brown. Mesonotum dark brown. Scutellum, postscutellum and abdomen dark reddish. Wings hyaline, costa reddish brown, the third vein just before the apex; halteres whitish transparent. Legs pale straw, lighter ventrally, tarsi darker; claws short, stout, uniformly curved, the pulvilli very large, twice the length of the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment short, greatly swollen; dorsal plate broad, deeply and narrowly incised. Type Cecid. 165.

Female. Length 2 mm. Antennae extending to the fourth abdominal segment, dark brown; 14 segments, the fifth sessile, with a length twice its diameter and tapering basally and apically. Palpi quadriarticulate, the segments short, the fourth with a length one-fourth greater than the third. Mesonotum shining dark brown. Scutellum and postscutellum reddish brown. Abdomen sparsely haired, fuscous yellowish, the ovipositor pale orange; halteres yellowish basally, fuscous apically. Wings hyaline, femora and coxae fuscous yellowish, the tibiae darker, the tarsi almost dark brown. The ovipositor three-fourths the length of the abdomen, the terminal lobes roundly tapering. Cecid. a2515.

Phytophaga latipes Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 370 (Mayetiola)

This pale yellowish midge was taken on New Jersey tea, C e a n o t h u s a m e r i c a n u s, at Albany, N. Y., July 6, 1906.

Male. Length 1 mm. Antennae a little shorter than the body, sparsely haired, dark brown, yellowish basally; 14 segments, the fifth with a stem one-half the length of the subcylindric basal enlargement, which latter has a length two and one-half times its diameter; terminal segment produced, the basal enlargement cylindric, with a length three times its diameter, apically a long, fingerlike appendage.

Palpi; the first segment stout, subquadrate, the second one-half longer, broad, the third as long as the second, slender, the fourth one-half longer and more slender than the third. Face yellowish. Mesonotum olive green, the submedian lines indistinct. Scutellum pale yellowish green, postscutellum darker. Abdomen pale yellowish, slightly greenish dorsally. Wings long, narrow, hyaline, costa light brown, the third vein just beyond the apex; Halteres pale yellowish, fuscous subapically. Legs a nearly uniform fuscous straw, the posterior

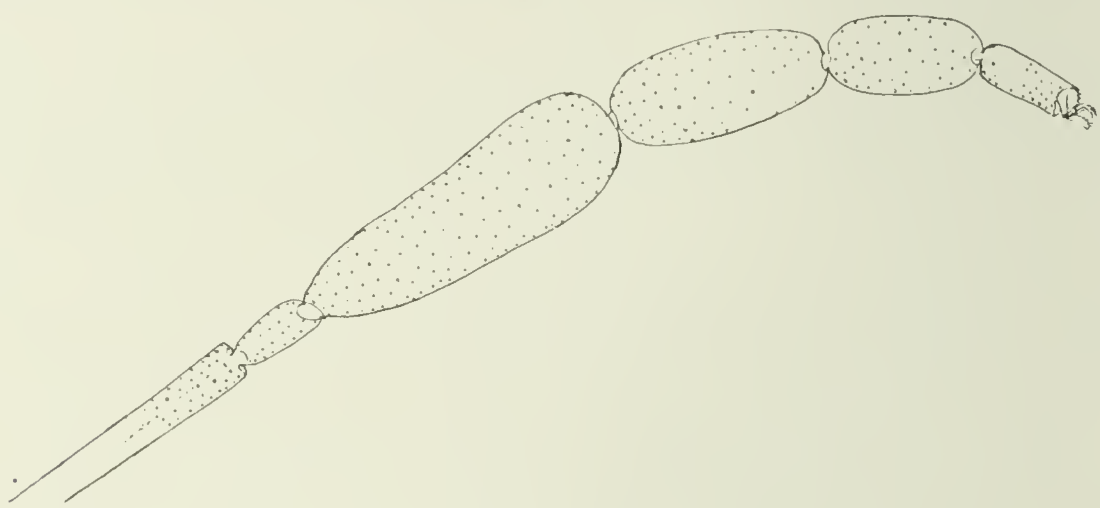


Fig. 45 Phytophaga latipes; posterior tarsus, enlarged (original)

tarsi with the second, third and fourth segments greatly dilated, the second with a length four times its diameter, the third with a length three times its diameter, the fourth a little shorter, more slender. Claws long, slender, evenly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment short, stout; terminal clasp segment long, stout, swollen basally; dorsal plate long, broad, broadly and roundly emarginate; ventral plate long, broad, broadly and roundly emarginate.

This form is peculiar in that the male antennae are almost identical in structure with those of certain female Diplosids. The wings are unusually long and narrow, the genitalia peculiar, while the most striking feature is the great dilation of certain segments of the posterior tarsi. Type Cecid. 511.

Phytophaga caulicola Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 370 (Mayetiola)

This reddish brown species was reared in some numbers from slender willow, Salix, twigs April 27, 1908 taken by Mr L. H. Weld at Evanston, Ill. The rather slender, orange larvae occur in long, oval cells in the pith or just beneath the bark about 1 mm in diameter and 3 to 5 mm long. This species was reared from the same twigs as Rhabdophaga caulicola.

Gall. The gall is indicated externally by very little or no swelling. Five to six or more larvae may occur in a portion of a willow stem 2 to 3 mm in diameter and 10 cm long.

Larva. Length 3 mm, dark orange. Head small; antennae long, tapering; breastbone bidentate, with a minute, median tooth, the shaft broad, heavily chitinized. Skin coarsely shagreened; posterior extremity broadly rounded.

Male. Length 1.75 mm. Antennae extending to the fourth abdominal segment, sparsely haired, dark brown; 16 segments, the fifth with a stem one-third the length of the basal enlargement, which latter has a length one-half greater than its diameter; terminal segment produced, with a length thrice its diameter, tapering, rounded apically. Palpi; first segment short, stout, the second with a length twice its diameter, narrowly oval, the third one-third longer, more slender, the fourth a little longer and more slender than the third. Mesonotum dark brown, the submedian lines thickly haired. Scutellum dark brown, postscutellum fuscous yellowish. Abdomen dark reddish brown, sparsely haired. Genitalia dark brown. Wings hyaline, costa yellowish, the third vein just before the apex. Halteres fuscous, reddish apically. Legs tinged with reddish and thickly clothed with silvery scales. Genitalia; basal clasp segment long, broad; terminal clasp segment long, stout; dorsal plate long, broad, deeply and triangularly incised; ventral plate long, broad, deeply and roundly emarginate. Harpes short, stout, truncate, with an irregular, quadrate tooth apically.

Female. Length 3 mm. Antennae extending to the third abdominal segment, sparsely haired, light brown, yellowish basally; 16 segments, the fifth with a length two and one-half times its diameter; terminal segment produced, with a length four times its diameter, constricted near the distal third. Palpi; first segment short, stout, irregular, the second with a length nearly three times its diameter, narrowly oval, the third one-half longer, more slender, the fourth a little longer and more slender than the third. Face fuscous yellowish. Mesonotum reddish brown, the submedian lines thickly haired. Scutellum reddish orange, postscutellum orange. Abdomen reddish brown; membrane and pleurae deep orange. Ovipositor fuscous yellowish. Halteres light fuscous yellowish. Coxae and base of femora fuscous yellowish; femora distally, tibiae and tarsi dark brown, the latter almost black; claws rather short, stout, strongly curved, the pulvilli longer than the claws. Ovipositor about half the length of the abdomen, stout, the terminal lobes narrowly oval. Type Cecid. a1822a.

Phytophaga tumidosae Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 370 (Mayetiola)

This dark brown species was reared from a subglobular gall on willow, Salix, April 11, 1908. It was taken by Mr L. H. Weld at Evanston, Ill.

Gall. Diameter, 4 mm subglobular, inhabited by a dark orange larva invariably occurring just below the bud. The bark covering the deformity is more or less ruptured and scarred. The infested

twigs are only 2 mm in diameter. Species of Polygnotus, Eurytoma and Decatoma were reared from this gall.

Larva. Length 2 mm, dark orange, rather stout. Head small; breastbone bidentate, somewhat expanded subapically, the shaft long, rather slender, heavily chitinized. Skin coarsely shagreened; posterior extremity irregularly rounded.

Female. Length 3 mm. Antennae extending to the second abdominal segment, sparsely haired, reddish brown; 16 sessile segments, the fifth with a length nearly three times its diameter; terminal segment reduced, subconic. Palpi; first segment subquadrate, the second broadly oval, the third a little longer, more slender, the fourth longer and more slender. Mesonotum dark slaty brown, submedian lines thickly haired. Scutellum, postscutellum and abdomen dark brown, the segments of the latter margined posteriorly with yellowish setae; membrane and pleurae reddish brown, the ventral sclerites dark brown. Wings hyaline, costa dark brown. Coxae, femora and tibiae fuscous yellowish; tarsi dark brown; claws long, stout, strongly curved, the pulvilli longer than the claws. Ovipositor one-half the length of the abdomen, the terminal lobes with a length three times the width, narrowly rounded. Type Cecid. 1300.

Phytophaga californica Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 370 (Mayetiola)

The yellowish brown species characterized below was reared from currant, R i b e s m e n z i e s i i, taken in February in Alameda county, California.

Male. Length 2.5 mm. Antennae nearly as long as the body, sparsely haired, light brown; 16 segments, the fifth with a stem one-third the length of the basal enlargement, which latter has a length two and one-half times its diameter; terminal segment reduced, narrowly oval. Palpi; first segment produced, swollen distally, second roundly rectangular, the third more than twice the length of the second, slender, the fourth nearly as long as the third, slender. Mesonotum yellowish brown, the submedian lines sparsely haired. Scutellum and postscutellum reddish brown. Abdomen sparsely haired, dark reddish brown; genitalia fuscous. Wings hyaline, costa pale straw. Halteres whitish basally, fuscous yellowish apically. Coxae and femora pale yellowish, the tibiae and tarsi a little darker; claws long, evenly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment stout; terminal clasp segment short, swollen; dorsal plate broad, triangularly emarginate; ventral plate long, deeply and broadly incised. Harpes stout, broadly rounded.

Female. Length 2.5 mm. Antennae extending to the second abdominal segment, sparsely haired, pale yellowish; 16 segments, the fifth with a stem one-fourth the length of the basal enlargement, which latter has a length nearly three times its diameter; terminal

segment narrowly oval, with a length nearly three times its diameter. Ovipositor about half the length of the abdomen; terminal lobes small, narrowly oval. Type Cecid. 919.

Phytophaga latipennis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 353 (Rhabdophaga)

Several specimens of this yellowish brown species were reared from inconspicuous, knotted galls on willow, probably the glaucus willow, presumably in the spring of 1905 or 1906 by Dr James G. Needham, then of Lake Forest, Ill.

Gall. This is an inconspicuous, knotted growth on willow.

Male. Length 2 mm. Antennae a little shorter than the body; 16 segments, the fifth with a stem three-fourths as long as the basal enlargement, which latter has a length twice its diameter; terminal segment slender, greatly produced, with a length four times its diameter. Palpi; first segment irregularly subquadrate, the second subrectangular, with a length three times its diameter, the third and fourth subequal, each about one-half longer than the second. Wings hyaline, the posterior margin distinctly produced to form a rather broadly rounded lobe. Genitalia; basal clasp segment long, stout; terminal clasp segment long, stout at base; dorsal plate long, broad, triangularly incised; ventral plate long, broad, broadly and angularly emarginate. Harpes stout, broadly rounded, with several irregular, conspicuous, chitinous processes. Color and other characters presumably nearly as in the female.

Female. Length 4 mm. Antennae extending to the fourth abdominal segment, sparsely haired, light brown; 15 segments, the fifth with a length two and one-half times its diameter, the terminal segment greatly produced, evidently composed of two closely fused. Palpi; nearly as in the male, except that the subequal third and fourth segments are relatively shorter. Mesonotum fuscous brown, the submedian lines indistinct. Scutellum fuscous, postscutellum probably the same. Abdomen yellowish brown. Wings hyaline, the third vein uniting with the margin a little before the apex, the anal angle less produced than in the male. Halteres yellowish basally, slightly fuscous apically. Legs a variable fuscous yellowish; claws stout, strongly curved, simple, the pulvilli nearly as long as the claws. Ovipositor about one-half the length of the abdomen, the terminal lobes with a length three times the width, narrowly rounded. Type Cecid. 782.

Phytophaga americana Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 370, 371 (Mayetiola)

This species was reared in some numbers from a very elongate, slender, swelling on willow twigs, Salix, received at the Bureau of Entomology, Washington, D. C., in May 1889 from O. S. Westcott of Maywood, Ill.

Gall. A very elongate, slender swelling of the twig, tapering at both ends.

Male. Length 1.5 mm. Antennae nearly as long as the body, thickly haired, yellowish brown; 17 segments, the fifth with a stem three-fourths the length of the basal enlargement, which latter has a length one-half greater than its diameter; terminal segment produced, tapering, acute. Palpi; first segment short, subquadrate, the second quadrate, with a length one-half greater than its diameter, the third a little longer, more slender, the fourth one-half longer than the third, more slender. Mesonotum dark brown, the submedian lines thickly haired. Scutellum yellowish brown, darker basally, postscutellum yellowish brown. Abdomen sparsely clothed with silvery hairs, dark brown (dark red in life). Genitalia fuscous yellowish. Wings hyaline, costa pale straw. Halteres yellowish basally, fuscous apically. Coxae, femora and tibiae pale yellowish, the tarsi slightly darker; claws long, slender, evenly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, truncate; terminal clasp segment long, tapering; dorsal plate broad, deeply and triangularly incised; ventral plate short, deeply and roundly emarginate. Harpes long, stout, obliquely truncate.

Female. Length 2 mm. Antennae extending to the second abdominal segment, sparsely haired, fuscous yellowish; probably 17 segments, the fifth subsessile, with a length two and one-half times its diameter; subbasal whorl thick, short, subapical band rather scattering, relatively short. Ovipositor about one-half the length of the abdomen, the terminal lobe with a length three times its width, broadly rounded. Type Cecid. 920.

Phytophaga destructor Say [1]

Hessian fly

1817 **Say, Thomas.** Acad. Nat. Sci. Jour., 1:45–48; same republished in Le Conte Say's Complete writings, 2:4–6, 1883 (Cecidomyia)

1847 **Fitch, Asa.** N. Y. State Agric. Soc. Trans., 6:316–73 (same, separate date 1847, p. 3–60, Cecidomyia)

1883 **Packard, A. S.** U. S. Ent. Com. 3d Rep't, 1883, p. 198–248 (Cecidomyia)

1897 **Marchal, Paul.** Soc. Ent. de Fr. Ann., 66:1–42, 43–47, 51–62, 80–100 (Mayetiola)

1898 **Osborn, Herbert.** U. S. Dep't Agric. Div. Ent. Bul. 16, n. s., p. 1–57 (Mayetiola).

1902 **Felt, E. P.** N. Y. State Mus. Bul. 53; Rep't for 1901, p. 705–30 (Mayetiola)

1909 **Hayhurst, Paul.** Econ. Ent. Jour., 2:231–34 (Mayetiola)

The Hessian fly is one of the best known representatives of the gall midges, owing to the fact that it lives in an important cereal

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[1] An extended economic bibliography is purposely omitted since so much of it is a repetition of well-known citations. The later publications cited below have extensive bibliographies.

and its ravages compel the attention of all. The popular name was bestowed in the belief that it was brought into this country in packing or straw shipped to the Hessian soldiers then stationed on Long Island. There is a strong probability that this is true, though it can never be proved beyond question.

An economic discussion of this species is unnecessary here and we have given therefore only technical descriptions of both sexes.

Male. Length 2 mm. Antennae one-fourth longer than the body, rather thickly haired, light brown; 18 to 20 segments, the fifth with a stem three-fourths the length of the cylindric basal enlargement, which latter has a length two and one-half times its diameter, terminal segment reduced, narrowly oval. Palpi; first segment irregularly obconic, the second subquadrate, the third one-third longer, more slender, the fourth about twice the length of the third. Abdomen reddish brown. Mesonotum shining dark brown, the submedian lines indistinct, the posterior median area a variable yellowish. Scutellum fuscous yellowish, postscutellum fuscous. Abdomen reddish brown, with a narrow, broken submedian line, incisures and pleurae whitish. Wings hyaline, costa light brown, the third vein at or just beyond the apex. Halteres yellowish basally, fuscous apically. Legs a variable fuscous yellowish; claws long, slender, evenly curved, minutely unidentate, the pulvilli longer than the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment long, stout; dorsal plate broad, deeply and triangularly emarginate, the lobes narrowly rounded; ventral plate short, broad, deeply and triangularly emarginate, the lobes rather long, broad, narrowly rounded. Harpes long, broadly rounded, with an irregular group of unusually long, subquadrate, chitinous spines. (Plate 18, figure 1).

Female. Length 3 mm. Antennae extending to the fourth abdominal segment, sparsely haired, light brown; 17-19 subsessile segments, the fifth with a length about two and one-half times its diameter; terminal segment slightly reduced, narrowly rounded apically. Palpi; first segment irregularly obconic, the second narrowly oval, the third a little longer, more slender, the fourth about twice the length of the third. Mesonotum dark brown, the submedian lines indistinct. Scutellum and postscutellum dark brown. Abdomen reddish brown, the incisures and pleurae yellowish red. Wings hyaline, costa dark brown, venation as in the opposite sex. Halteres pale yellowish. Legs fuscous yellowish; claws stout, evenly curved, simple, the pulvilli longer than the claws. Ovipositor short, stout, the terminal lobes short, broadly rounded.

Phytophaga rigidae O. S.

1845 **Fitch, Asa.** Am. Quar. Jour. Agric. & Sci., 1:263-69 (C e c i d o m y i a s a l i c i s)

1862 **Osten Sacken, C. R.** Mon. Dipt. N. A., 1:189 (C e c i d o m y i a)

1864 **Walsh, B. D.** Ent. Soc. Phila. Proc., 3:590–91 (Cecidomyia cornu); 591–95 (Cecidomyia siliqua); 595–98 (Cecidomyia)
1867 ———— Ent. Soc. Phila. Proc., 6:224–25 (C. siliqua)
1870 **Riley, C. V.** Amer. Ent., 2:214 (Cecidomyia)
1874 **Glover, Townend.** Notes from My Journal (Cecidomyia)
1885 **Riley, C. V.** Bul. 5, U. S. Dep't Agric., Bur. Ent., p. 16 (Encyrtus cecidomyiae Riley parasite of, Cecidomyia)
1890 **Cockerell, T. D. A.** Entomologist, p. 278–79
1892 **Beutenmueller, William.** Bul. Amer. Mus. Nat. Hist., 4:268 (Cecidomyia)
1895 **Baker, C. F.** Ent. News 6:173 (Ft. Collins, Col., Cecidomyia siliqua)
1903 **Cook, M. T.** Ohio Univ. Bul., ser. 7, no. 20, p. 422 (Cecidomyia)
1904 **Beutenmueller, William.** Amer. Mus. Nat. Hist. Guide Leaflet no. 16, p. 29 (Cecidomyia)
1904 **Cook, M. T.** Dep't Geol. & Nat. Res. Ind., 29th Rep't, p. 840 (C. siliqua)
1906 **Felt, E. P.** Ins. Affect. Prk. & Wdld. Trees, N. Y. State Mus. Mem. 8, v. 2, p. 745 (Rhabdophaga siliqua)
1906 ———— N. Y. State Mus. Bul. 104, p. 122–25 (Rhabdophaga)
1906 **Cockerell, T. D. A.** Ent. News, 17:398 (Rhabdophaga)
1907 **Jarvis, T. D.** 37th Rep't Ent. Soc. Ont., p. 68 (Cecidomyia)
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 371 (Mayetiola)
1909 **Brodie, William.** Can. Ent., 41:251–52 (Rhabdophaga siliqua = R. rigidae O. S.)
1909 **Felt, E. P.** Ent. Soc. Ont., 39th Rep't, p. 45 (Mayetiola)
1909 **Jarvis, T. D.** Ent. Soc. Ont., 39th Rep't, p. 92 (Mayetiola)
1910 **Cook, M. T.** Mich. Geol. & Biol. Surv. Pub. 1, Biol. Ser. 1, p. 31 (Cecidomyia)
1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul. 2, p. 5, 7, 10 (Mayetiola)

The gall produced by this species on willow is very characteristic, relatively common in New York State at least and appears to be widely distributed, having been received from Aweme, Manitoba, Logan, Utah and St Louis, Mo., not to mention its somewhat general occurrence in the eastern states. The adults appear in the latitude of Albany during the early part of May. The species winters as reddish larvae in the galls. There is but one generation annually. The reddish brown males may be recognized by the 24 antennal segments, the fifth with a stem one-half the length of the basal enlargement. The female has 24–26 sessile segments, the fifth with a length one-half greater than its diameter. The wing is illustrated on plate 17, figure 2.

This midge was originally described by Fitch in the American Quarterly Journal of Agriculture and Science, as Cecidomyia salicis. Later, Osten Sacken proposed this specific name for the preoccupied salicis. This species was apparently redescribed by Walsh as Cecidomyia siliqua. Kertesz, in 1902, makes

both salicis Fitch and rigidae O. S. synonyms of the Walsh species. The preceding, we do not believe, can be justified by the rules of priority. Torymus ostensackenii D. T. was reared from this midge.

Gall. This is an apical or subapical deformity, fusiform in shape, about an inch long and tipped with a rather characteristic, slender, curved beak. (Plate 10, figure 2). Galls producing parasites only are almost invariably smaller and usually vary somewhat from the normal.

Phytophaga walshii Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 371 (Mayetiola)

This species was reared at Lake Michigan Beach, Ill., on spongy or clustered galls on dwarf willow, by Prof. James G. Needham, presumably in the spring of 1906.

Gall. This is described by Professor Needham simply as a spongy or clustered gall on dwarf willow, possibly only a variety of Rhabdophaga strobiloides Walsh. (Plate 12, figure 1).

Larva. Stout, 5 mm long, yellowish or yellowish white, broadly rounded. Head small; antennae short, tapering; breastbone bidentate, the points diverging, the shaft rudimentary. Skin coarsely shagreened; posterior extremity broadly rounded.

Male. Length 4 mm. Antennae extending to the sixth abdominal segment, very thickly haired, light brown; 25–26 segments, the fifth with a stem three-fourths the length of the basal enlargement, which latter has a length one-half greater than its diameter; terminal segment produced, slender. Palpi; first segment narrowly oval, second a little broader, third one-third longer than the second, slender, the fourth about as long as the third. Mesonotum reddish brown. Scutellum yellowish brown, postscutellum fuscous. Abdomen pale yellowish. Wings; costa yellowish brown. Halteres yellowish white, fuscous subapically. Legs a variable brown; claws long, slender, the pulvilli as long as the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment short, swollen basally; dorsal plate long, deeply and triangularly emarginate, ventral plate long, deeply and triangularly emarginate. Harpes short, stout, truncate.

Female. Length 5 mm. Antennae extending to the second abdominal segment, sparsely haired, light brown; 26 sessile segments, the fifth with a length two and one-half times its diameter; terminal segment broadly fused with the preceding. Mesonotum reddish brown. Scutellum yellowish brown, postscutellum fuscous. Abdomen pale yellowish. Pulvilli a little longer than the claws. Ovipositor about half the length of the abdomen, the terminal lobes short, broadly rounded. Type Cecid. 774.

Phytophaga celtiphyllia Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 371 (Mayetiola)

The reddish brown species described below was reared in May 1900 from obconic leaf galls on leaves of hackberry, Celtis, taken by Mr J. M. Shaffer at Keokuk, Iowa, and sent to the Division of Entomology, United States Department of Agriculture. Apparently the same form was reared by Mr Pergande from similar galls on young twigs of hackberry collected by E. A. Schwarz at Corpus Christi, Texas, in 1895.

Gall. Very hard, obconic, the upper extremity produced as a long, slender nipple; at the base five or six low ridges. The galls are smooth inside and divided by a delicate though dense web into two compartments, the larva occurring in the lower. The galls occur on the upper side of the leaf and drop when mature. (Notes by Pergande)

Larva. Pale yellowish, with a brown breastbone. (Notes by Pergande)

Male. Length 3 mm. Antennae nearly as long as the body, sparsely haired, light brown; 22 to 23 segments, the fifth with a stem as long as the basal enlargement, which latter has a length twice its diameter; terminal segment reduced, tapering, obtuse. Palpi; first segment short, stout, irregular, the second rather stout, with a length twice its diameter, the third a little longer and stouter, the fourth apparently missing. Mesonotum shining dark brown, the submedian lines thickly clothed with fulvous hairs. Scutellum yellowish brown, sparsely setose apically, postscutellum fuscous yellowish. Abdomen reddish brown. Wings hyaline, costa light brown, the third vein at the apex. Halteres yellowish basally, reddish brown apically. Legs a variable reddish brown, the segments darker apically; claws long, slender, evenly curved, the pulvilli a little shorter. Genitalia; basal clasp segment long, stout; terminal clasp segment long, swollen near the middle; dorsal plate long, broad, broadly and triangularly incised; ventral plate short, broad, deeply and roundly incised. Harpes short, stout, obliquely truncate.

Female. Length 3.5 mm. Antennae extending to the fifth abdominal segment, sparsely haired, reddish brown; 24 segments, the fifth cylindric, with a length two and one-half times its diameter; terminal segment produced, broadly rounded. Palpi; first segment short, stout, irregularly oval, the second one-half longer, stout, the third twice the length of the second, more slender, the fourth one-fourth longer than the third, somewhat dilated. Ovipositor probably as long as the body, the terminal lobes slender, with a length about four times the diameter, tapering, narrowly rounded. Other characters practically as in the male. Type Cecid. 913.

Phytophaga perocculta Ckll.

1904 **Cockerell, T. D. A.** Canad. Ent., 36:156 (Cecidomyia)
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 371 (Mayetiola)

Examples of this form were received from Prof. T. D. A. Cockerell, labeled Colorado Springs, April 21st. The specimens were reared from the stems of willow, Salix.

Male. Length 2 mm. Antennae about as long as the body, dark brown, thickly long-haired; 20 segments, the fifth with a stem three-fourths the length of the basal enlargement, which latter has a length one-third greater than its diameter; terminal segment produced, tapering, narrowly rounded. Palpi; the first segment rather long, expanded distally, the second a little longer, roundly subquadrate, the third as long as the second, more slender, the fourth one-third longer than the third, slender. Mesonotum dark brown, the submedian lines thickly clothed with very long hairs, they having a length equal to more than two-thirds the width of the mesonotum. Scutellum dark brown, postscutellum a little darker. Abdomen very dark brown and thickly clothed with long, fuscous hairs, the latter having a length about equal to the diameter of the abdomen; genitalia fuscous. Wings hyaline, costa light brown, the third vein uniting with the anterior margin just before the apex. Halteres yellowish basally, fuscous apically. Legs a variable fuscous yellowish, the extremities of the segments usually darker, the posterior tarsi a lighter fuscous yellowish; claws long, stout, strongly curved distally, the pulvilli a little longer than the claws. Genitalia; basal clasp segment short, very stout; terminal clasp segment short, stout, greatly swollen; dorsal plate short, broad, deeply and triangularly emarginate; ventral plate long, narrow, broadly and roundly emarginate. Harpes short, stout, tapering, irregularly oblique, with several subquadrate tubercles.

Described from the dried type specimens kindly donated by Prof. T. D. A. Cockerell. Type Cecid. 1251.

Janetiella Kieff.

1897 **Kieffer, J. J.** Syn. Cecid. Eur. & Alg., p. 23
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 371
1910 **Rubsaamen, E. H.** Zeitsch. Wissenschaft. Insektenbiol., 15:336
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:46
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 58

This genus, when erected, was separated from Oliogotrophus by the elongate, quadriarticulate palpi, and from Phytophaga by the third vein uniting with the anterior margin of the wing and not extending to its apex. The first species named, J. thymi Kieff., we take as the type of the genus. This species, according to its describer, has 14 antennal segments in both sexes, the middle flagellate segment in the male having a stem with a length equal to the ovate basal enlargement, which latter is provided with two whorls of hairs. The ses-

sile, flagellate segments of the female are cylindric, subsessile, with a length twice the diameter and with an irregular subbasal whorl. Ovipositor probably one-half the length of the body, stout; the lobes are narrowly lanceolate, setose and twice as long as broad.

Key to species

a 12 antennal segments
b Abdomen light brown, the dorsal plate triangularly emarginate; male
tiliacea Felt, C. 83
bb Abdomen fuscous yellowish, the dorsal plate deeply and broadly emarginate; male....................brevicornis Felt, C. 281
bbb Abdomen red, the ovipositor rather short; female
sanguinea Felt, C. 17
bbbb Abdomen orange red, ovipositor nearly as long as the abdomen
ligni n.sp., C. a2109w
aa 14 antennal segments
b Abdomen reddish brown, the fifth antennal segment with a stem one-third the length of the basal enlargement; male........nodosa Felt, C. 10
bb Abdomen fuscous yellowish, the fifth antennal segment with a stem three-fourths the length of the basal enlargement; male
americana Felt, C. 616
bbb Abdomen yellowish orange, the fifth antennal segment sessile, with a length two and one-half times its diameter. Reared from pine needle swellings....................coloradensis Felt, C. a2287
aaa 15 antennal segments
b Abdomen deep orange and yellowish, the fifth antennal segment of the male with a stem three-fourths the length of the basal enlargement; female with the ovipositor two-thirds the length of the abdomen; reared from a fleshy leaf fold on Myrica..............asplenifolia Felt, C. 1103
bb Abdomen dark brown basally, reddish apically, the fifth antennal segment with a stem one-half longer than the basal enlargement
acerifolia Felt, C. 35
bbb Abdomen reddish brown; ovipositor short; reared from Lasioptera vitis gall..........................brevicauda Felt, C. 878
aaaa 16 antennal segments
b Abdomen yellowish red, the fifth antennal segment with a stem one-fourth longer than the basal enlargement; male.............pini Felt, C. 87
bb Abdomen yellowish orange, fifth antennal segment with a stem twice the length of the basal enlargement...............parma Felt, C. 1488
bbb Abdomen dark brown; antennal segments sessile, ovate, the fifth with a length twice its diameter, the ovipositor one-fourth the length of the abdomen...............................breviaria Felt, C. 77

Janetiella tiliacea Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 121–22 (separate, p. 25) (Oligotrophus)
1908 ———— N. Y. State Mus. Bul. 124, p. 371

This light brown male was taken on basswood, Tilia americana, at Westfield, N. Y., May 23, 1906.

Male. Length .75 mm. Antennae hardly extending to the base of the abdomen, sparsely haired, dark brown; 12 segments, the fifth subsessile; terminal segment slightly produced, obtuse distally. Palpi; the first and second segments short, subquadrate, the third about the length of the two preceding, slender, the fourth a little longer and more slender than the third. Face reddish brown. Mesonotum dark brown, the submedian lines thickly clothed with brownish hairs. Scutellum reddish brown, postscutellum dark brown. Abdomen light brown with a yellowish cast laterally. Wings hyaline, costa light brown. Halteres pale reddish basally, yellowish white apically. Legs pale brown, lighter ventrally; tarsi a little darker; claws slender, uniformly curved. Genitalia; basal clasp segment stout, basally, a long, quadrate internal lobe; terminal clasp segment stout; dorsal plate broad, deeply and broadly emarginate; ventral plate broad, deeply and roundly emarginate. Type Cecid. 83.

Janetiella brevicornis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 122 (separate, p. 25–26) (Oligotrophus)

1908 ———— N. Y. State Mus. Bul. 124, p. 372

This fuscous yellowish species was taken on Solidago at Nassau, N. Y., June 14, 1906.

Male. Length 1 mm. Antennae extending to the base of the abdomen, rather thickly haired, dark brown, yellowish basally; 12 segments, the fifth with a length a little greater than its diameter; terminal segment slightly prolonged, ovoid. Palpi; the first segment short, subquadrate, the second twice the length of the preceding, narrowly oval, the third one-half longer, much more slender, slightly dilated subapically, the terminal segment about as long as the preceding, slightly broader; face pale yellowish. Mesonotum dark brown with submedian lines yellowish, sparsely ornamented with fine setae. Scutellum reddish orange, postscutellum dark brown. Abdomen nearly uniform fuscous yellowish, genitalia somewhat fuscous. Wings hyaline, costa dark brown; halteres whitish transparent basally, yellowish apically. Legs nearly uniform pale straw, the distal segments dark brown; claws rather slender, uniformly curved. Genitalia; basal clasp segment long, stout; terminal clasp segment short, stout, slightly swollen at the basal third; dorsal plate broad, deeply and triangularly emarginate; ventral plate narrow, deeply and roundly emarginate. Harpes short, stout, irregularly tuberculate, truncate. Type Cecid. 281.

Janetiella sanguinea Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 372

The reddish female described below has 12 subsessile antennal segments and a rather short ovipositor. It was taken in the vicinity of wild cherry, Prunus serotina, at Nassau, N. Y., May 15, 1906.

Female. Length 1.5 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown; 12 segments, the fifth subsessile, one-half longer than the diameter; terminal segment subconical. Palpi; the first segment rounded, short, stout, the second twice the length of the first, somewhat rounded, the third a little longer than the second, more slender, the fourth one-half longer than the third, more slender. Head and mesonotum black. Scutellum red, postscutellum dark brown. Abdomen red, sparsely clothed with blackish hairs. Wings subhyaline, unspotted, costa dark brown, rather thickly clothed basally with narrow scales; halteres yellowish transparent. Legs yellowish brown, tarsi reddish brown; claws stout, strongly curved. Ovipositor short, the terminal lobes somewhat stout, broadly rounded. Type Cecid. 17.

Janetiella ligni n. sp.

The small, reddish female described below was reared May 8, 1911 from decaying chestnut bark collected at Nassau, N. Y., and infested by various Dipterous larvae, including Winnertzia pectinata Felt. This form presents a superficial resemblance to Miastor.

Female. Length 1.25 mm. Antennae very short, dark brown, reddish brown basally; 12 sessile segments, the third and fourth rather closely fused, the fifth subcylindric, tapering distally, with a length about three-fourths its diameter and low, broad circumfili at the basal third and subapically suggesting those of Lasioptera; terminal segment narrowly oval. Palpi; first segment narrowly oval, with a length nearly twice its diameter, the second subquadrate, with a length about one-fourth greater than its diameter, the third and fourth subequal, each with a length nearly twice that of the third and dilated apically. Mesonotum dark brown. Scutellum reddish, postscutellum and abdomen orange red. Ovipositor yellowish. Wings hyaline. Halteres reddish. Coxae reddish; femora and tibiae fuscous straw, the tarsi slightly darker. Ovipositor nearly as long as the abdomen, the terminal lobes with a length nearly three times the width, narrowly rounded. Type Cecid. a2109w.

Janetiella nodosa Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 123 (separate, p. 27)
1908 ———— N. Y. State Mus. Bul. 124, p. 372

The male was taken in the vicinity of pine and around hornbeam, Carpinus caroliniana, at Albany, N. Y., April 28, 1906.

Male. Length 1.25 mm. Antennae extending to the middle of the abdomen, sparsely haired, dark brown; 14 segments, the fifth with a stem one-third the length of the stout basal enlargement. Palpi; the first segment short, the second a little longer than the first, swollen basally, the third more slender, one-half longer than the second, the fourth one-fourth longer than the third. Face and

mesonotum dark brown. Abdomen reddish brown, incisures orange brown. Wings hyaline, larger veins brown. Halteres yellowish transparent. Legs yellow with reddish tints. Tibiae apically, and tarsi fuscous; claws stout, slightly curved. Genitalia; basal clasp segment very broad; terminal clasp segment slightly swollen basally; dorsal plate broad, deeply incised; ventral plate broad, deeply and roundly emarginate. Harpes broadly rounded. (Plate 17, figure 7.) Type Cecid. 10.

Janetiella americana Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 372

The fuscous yellowish male was taken on willow, Salix, at Albany, N. Y., July 17, 1906.

Male. Length 2 mm. Antennae as long as the body, sparsely haired, light brown, yellowish basally; 14 segments, the fifth with a stem three-fourths the length of the basal enlargement, which latter has a length twice its diameter; terminal segment slightly produced, tapering. Palpi; first segment orbicular, second with a length three times its width, the third one-third longer than the second, more slender, the fourth longer and more slender than the third. Face fuscous yellowish. Mesonotum dark brown, the submedian lines indistinct. Scutellum fuscous yellowish, postscutellum deep red. Abdomen sparsely haired, dull fuscous yellowish; genitalia brown. Costa dark brown. Halteres whitish basally, reddish fuscous apically. Legs a nearly uniform pale straw, the tarsi variably tinged with carmine. Claws slender, evenly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment short, stout, terminal clasp segment short, swollen basally; dorsal plate short, broad, broadly and angularly emarginate; ventral plate short, deeply and roundly emarginate. Harpes long, slender, minutely dentate. Type Cecid. 616.

Janetiella coloradensis Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20:148–49

This species was reared from oval swellings at the base of pine needles by Prof. E. Bethel, Denver, Col.

Janetiella asplenifolia Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 159–60
1908 ———N. Y. State Mus. Bul. 124, p. 372

This species was collected and reared by the late Dr M. T. Thompson of Worcester, Mass., from a fleshy fold or lamina near the midvein on the leaves of sweet fern, Myrica asplenifolia. This gall was also taken by Miss Cora H. Clarke at Magnolia, Mass., July 27, 1908.

Fig. 46 Janetiella asplenifolia; gall on sweet fern leaves, nearly natural size (original)

Fig. 47 Janetiella asplenifolia; fifth antennal segment of male, enlarged (original)

Gall. Length 2 to 4 mm, shining and often reddish. It is a fleshy fold near the midvein, frequently producing curling or even recurving of the leaf. (Plate 9, figure 3.) One or more larvae inhabit the deformity.

Male. Length 2 mm. Antennae nearly as long as the body, sparsely haired, light fuscous yellowish; 15 segments, the fifth with a stem about three-fourths the length of the basal enlargement, which latter has a length about one-half greater than its diameter; the terminal segment produced, narrowly oval. Palpi; the first segment short, stout, subquadrate, second a little longer, more slender, the third one-half longer than the second and the fourth longer and more slender than the third. Mesonotum dark brown, the narrow submedian lines and posterior median area yellowish. Scutellum and postscutellum fuscous yellowish. Abdomen a deep orange yellow, the distal segments paler, the

incisures and pleurae pale salmon, genitalia fuscous yellowish. Wings hyaline, costa light brown. Halteres yellowish transparent. Legs

Fig. 48 Janetiella asplenifolia; fifth antennal segment and claw of female, enlarged (original)

pale yellowish, the femora dorsally blackish, tibiae and tarsi progressively more fuscous apically; claws long, slender, strongly curved, the

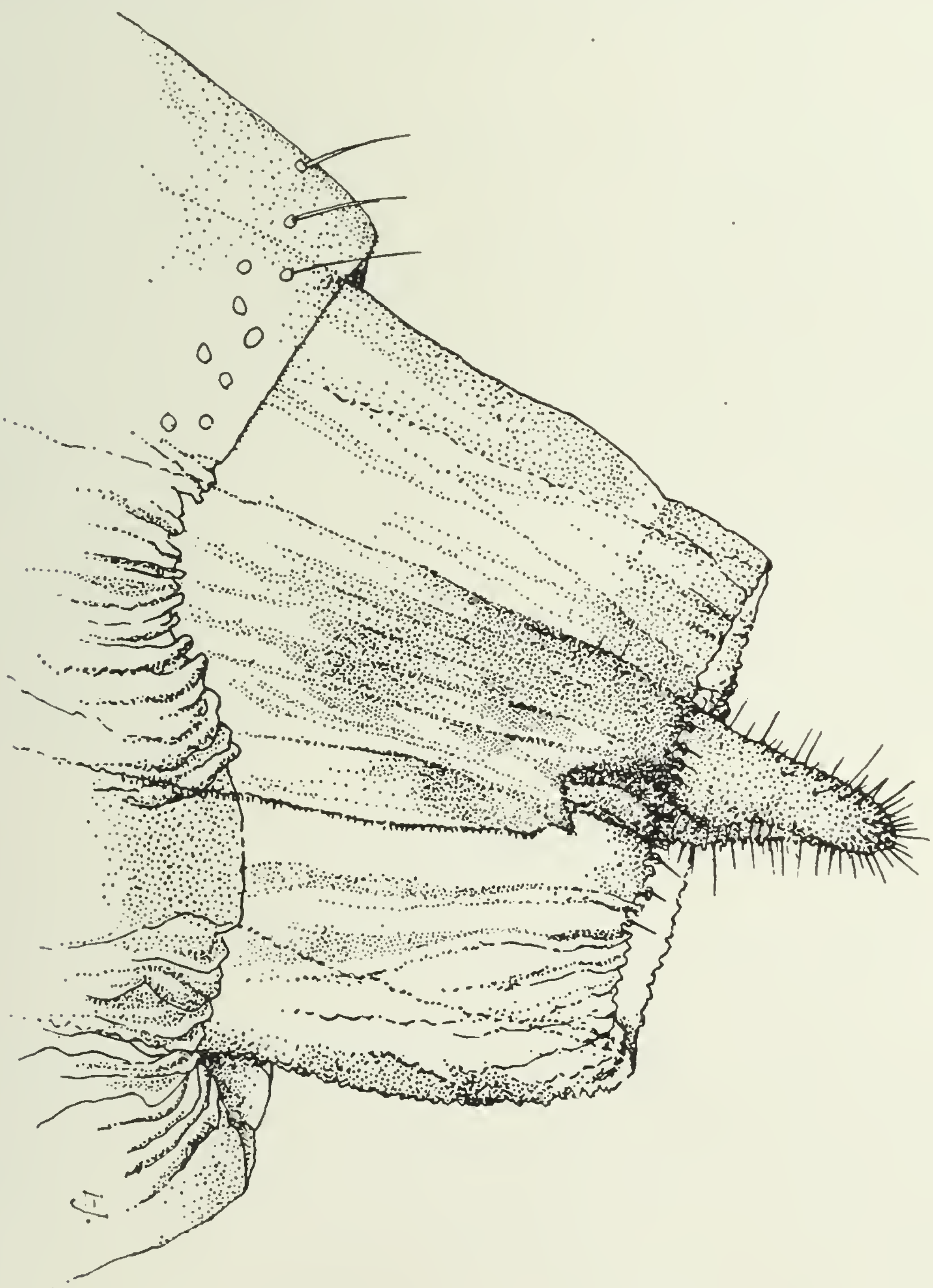


Fig. 49 Janetiella asplenifolia; lateral view of the tip of the abdomen showing a portion of the long ovipositor, enlarged (original)

pulvilli as long as the claws. Genitalia; basal clasp segment long, stout, broadly rounded; terminal clasp segment long, slender, swollen near the middle; dorsal plate broad, deeply and triangularly incised; ventral plate long, deeply and broadly incised.

Female. Length 1.75 mm. Antennae sparsely haired, pale yellowish; presumably 15 segments, the fifth subsessile, with a length about twice the diameter; claws rather long, stout, evenly curved, the pulvilli a little longer than the claws. Ovipositor probably two-thirds the length of the abdomen, the terminal lobes long. Otherwise nearly as in the male. Type Cecid. 1103.

Janetiella acerifolia Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 124 (separate, p. 27) (Oligotrophus)

1908 ———— N. Y. State Mus. Bul. 124, p. 372

This dark brown species was taken at Albany, N. Y., May 17, 1906 along a hedge row containing maple, elm, shadbush and other plants.

Male. Length 1.5 mm. Antennae probably nearly as long as the body, sparsely long-haired, dark brown; 15 segments, the fifth with a stem one-half longer than the basal enlargement; terminal segment subconical, apex broadly rounded. Palpi; the first segment obpyriform, the second a little longer, subrectangular, the third one-half longer than the fourth, strongly flattened and the fourth about as long as the third. Mesonotum dark brown. Scutellum and postscutellum reddish brown, basal abdominal segment dark brown, other segments reddish, spotted with carmine; genitalia dark brown. Wings hyaline, costa dark brown; halteres yellowish transparent at base, slightly fuscous apically, very long. Legs a variable brown, lighter ventrally, tarsi slightly darker; claws slender, slightly curved. Genitalia; basal clasp segment stout; terminal clasp segment stout basally; dorsal plate broad, deeply incised; ventral plate narrow, deeply incised; harpes stout, tapering. Type Cecid. 35.

Janetiella brevicauda Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 372

This reddish brown species was reared June 22, 1881 from the typical gall of L a s i o p t e r a v i t i s on grape, Vitis.

Female. Length 1.25 mm. Antennae extending to the base of the abdomen, sparsely haired, light yellowish; 15 segments, the fifth subsessile, with a length about one-fourth greater than its diameter; terminal segment reduced, narrowly rounded. Palpi; first segment subquadrate, the second with a length four times its diameter, the third a little shorter than the second, the fourth a little longer than the third. Face reddish yellow. Mesonotum reddish brown. Scutellum yellowish red, postscutellum a little

darker. Abdomen a variable reddish brown or salmon. Wings hyaline, costa dark brown. Halteres yellowish basally, fuscous apically. Legs a nearly uniform pale yellowish; claws slender strongly curved, the pulvilli nearly as long as the claws. Ovipositor short, terminal lobes with a length over twice the width, narrowly rounded. Type Cecid. 878.

Janetiella pini Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 124 (separate, p. 28)
1908 ———— N. Y. State Mus. Bul. 124, p. 372

This yellowish red male was taken on pine, Pinus strobus, at Albany, N. Y., May 26, 1906.

Male. Length 2.5 mm. Antennae longer than the body, dark brown, sparsely clothed with long, whitish hairs; 16 segments, the fifth with a stem one-fourth longer than the basal enlargement; terminal segment produced, subcylindric, rounded. Palpi; the first segment presumably short, the second a little longer than the first, the third one-half longer than the second, and the fourth one-fourth longer than the third. Mesonotum dark brown, reddish posteriorly. Scutellum and postscutellum reddish. Abdomen yellowish red. Wings hyaline, costa light brown. Halteres yellowish basally, reddish fuscous apically. Coxae pale yellowish; femora light brown distally, lighter ventrally; tibiae and tarsi light brown, the former darker distally; terminal tarsal segments somewhat darker; claws slender, slightly curved. Genitalia; basal clasp segment long; terminal clasp segment stout; dorsal plate broad, deeply incised; ventral plate narrow, deeply and roundly emarginate. Harpes broad at base, tapering, apically, a subquadrate tooth. Type Cecid. 87.

Janetiella parma Felt

1914 **Felt, E. P.** N. Y. Ent. Soc. Jour., 22:129-30

This yellowish midge was taken by C. P. Alexander in a bog swamp at Woodworth's lake in the Adirondacks, June 21, 1909.

Janetiella breviaria Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 372

This dark brown female was taken at Albany, N. Y., May 21, 1906.

Female. Length .75 mm. Antennae extending to the third abdominal segment, sparsely haired, dark brown; 16 subsessile segments, the fifth with a length one-half greater than its diameter; terminal segment produced, broadly rounded. Palpi; the first segment suborbicular, the second lanceolate, the third one-half longer than the second, and the fourth a little longer than the third. Mesonotum dark brown. Scutellum, postscutellum and abdomen

dark brown. Wings hyaline, costa light brown. Halteres brownish, fuscous basally, fuscous transparent distally. Legs dark brown, lighter ventrally. Ovipositor about one-fourth the length of the abdomen, the terminal lobes broad at base and broadly rounded. Type Cecid. 77.

OLIGOTROPHUS Latr.

1805 **Latreille, P. A.** Hist. Nat. Crust. et Ins., 14:288
1850 **Loew, H.** Dipt. Beitr., 4:20, 21 (Cecidomyia in part)
1877 **Karsch, F. A. F.** Revis. de Gallmucken, p. 16
1892 **Rubsaamen, E. H.** Berln. Ent. Zeitschr., 37:328, 376
1895 **Kieffer, J. J.** Wien Ent. Zeit., 14:10
1896 ——— Wien Ent. Zeit., 15:88, 89
1897 ——— Syn. Cecid. de Eur. & Alg., p. 22
1900 ——— Soc. Ent. Fr. Ann., 69:437
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 368
1910 **Rubsaamen, E. H.** Zeitsch. Wissenschaft. Insektenbiol., 15: 336
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:46
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 49

The type species is Tipula juniperina Linn. According to Kieffer this species has triarticulate palpi, though Rubsaamen holds these organs to be quadriarticulate. This species, according to Schiner, has the third vein ending at the point of the wing, the male antennae shorter than the body, composed of 20 segments, the three basal joints sessile, the following with a stem shorter than the roundish basal enlargement, which latter is provided with three whorls of hairs. The female has shorter antennae, the flagellate segments with only a short stem. An examination of a specimen in the British Museum, identified by Winnertz as Cecidomyia juniperiana Linn., shows that it has the general appearance of Phytophaga rigidae O. S. The palpi are probably quadriarticulate.

Key to species

a 13 or 14 antennal segments, abdomen dark brown
b 13 or 14 sessile antennal segments, the fifth having the basal enlargement with a length one-fourth greater than its diameter, the third palpal segment twice the length of the second; female; reared from Betula seeds.................................betulae Winn., C. 964
bb 14 antennal segments
c Fifth antennal segment with a stem about one-fourth the length of the basal enlargement, which latter has a length twice its diameter, the third palpal segment three times the length of the second, female
vernalis Felt, C. 60

cc Fifth antennal segment of the male with a stem as long as the basal enlargement, that of the female cylindric, with a length two and one-half times its diameter, the third palpal segment shorter than the second; reared from an ovoid leaf gall on Salix humilis
salicifolius Felt, C. a2017

ccc Fifth antennal segment of the female sessile, with a length one-half greater than its diameter, the third palpal segment three-fourths the length of the second; reared from Juniperus
betheli Felt, C. a2303

aa 15 antennal segments

b Abdomen dark brown, the fifth antennal segment with a stem one-third the length of the basal enlargement; male; reared from Betula seeds
betulae Winn., C. 964

aaa 16 antennal segments

b Abdomen fuscous yellowish, the fifth antennal segment with a stem one-fourth longer than the basal enlargement; reared from apical rosette gall on Solidago..........................inquilinus Felt, C. a1655a

Oligotrophus betulae Winn.

1886 **Lintner, J. A.** State Ent. 3d Rep't, p. 85–86 (Cecidomyia)
1886 ———— Count. Gent., 51:287 (Cecidomyia)
1888 ———— Inj. & Other Ins., 4th Rep't, p. 27 (parasites, Cecidomyia)
1892 **Theobald, F. V.** An Account of British Flies, p. 63
1896 **Lintner, J. A.** Inj. & Other Ins. N. Y., 11th Rep't, p. 162–65 (Cecidomyia)
1906 **Felt, E. P.** Ins. Affect. Prk. & Wdld. Trees, N. Y. State Mus. Mem. 8, 2:621, 647
1908 ———— N. Y. State Mus. Bul. 124, p. 368

This insect was first observed in America in 1886, when deformed white birch catkins were submitted to Dr J. A. Lintner with an inquiry as to the cause of the abnormal condition. It has become established in Albany, the catkins of white birches in Washington Park in particular being rather badly infested in some seasons. This insect was so abundant in 1887 that about half of the catkins were affected. It was observed at New Haven, Conn., in 1902. The presence of this gall-maggot is easily detected, particularly after pupation, because of the windowlike spot rendering the insect visible beneath. The normal alate seed is transformed into a globose gall with rudimentary alae.

Life history. There is evidently but one generation annually, the larvae becoming full grown late in the fall, wintering in the affected galls, and the adults appearing in early spring. This species occurs in Europe on Betula alba and a Swedish variety of B. pendula, known as B. valecardia. European parasites are Torymus pallidicornis Boh. and Leucopis

griseola. Several species have been reared from American specimens and found to be different from the old world enemies.

Oligotrophus vernalis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 368

The female was taken on basswood, Tilia americana, at Karner, N. Y., May 19, 1906.

Female. Length 1.5 mm. Antennae about as long as the body, sparsely haired, reddish brown; 14 segments, the fifth with a stem about one-fourth the length of the basal enlargement, which latter is distinctly rounded basally and apically; terminal segment slightly prolonged, subovoid, with a distinct subconical knob apically. Palpi; the first segment subquadrate, stout, the second suboval, a little longer than the first, the third longer than the preceding, rather stout. Mesonotum dark brown, submedian lines ornamented with setae. Scutellum yellowish, thickly clothed apically with dark setae, postscutellum yellowish, ferruginous. Abdomen dark brown, tinged with reddish. Wings hyaline, costa reddish brown; halteres reddish transparent. Coxae and femora yellowish red, tibiae and tarsi variable reddish brown and yellow; claws stout, uniformly curved. Ovipositor nearly as long as the abdomen, terminal lobe rather slender, narrowly rounded. Type Cecid. 606.

Oligotrophus salicifolius Felt

1910 **Felt, E. P.** Econ. Ent. Jour., 3: 354

The irregular, yellowish, red-spotted galls of this species on the leaves of Salix humilis were taken at Karner September 7, 1909, adults being reared in March and April of the following year. The deep orange larvae appear to desert the galls in late fall, spinning oval, yellowish cocoons attached to any hard substance such as a leaf. The gall is very similar to that of O. capreae Winn. and the adults are evidently closely allied though separable in color characteristics.

Gall. Length 2 to 3 mm, irregular, ovoid, monothalamous, yellowish, red-spotted and usually most evident on the under surface of the leaves of Salix humilis.

Larva. Length 1.75 mm, rather stout, deep orange. Head small; breastbone rudimentary or wanting; skin roughly shagreened; posterior extremity broadly rounded, slightly lobed.

Cocoon. Length 1.75 mm, white, narrowly oval, somewhat irregular and attached to a dead leaf.

Exuviae. Length 1.25 mm, whitish transparent; thoracic spines stout, slightly curved; antennal cases extending to the second

abdominal segment, the wing pads to the third and the leg cases to the fourth; posterior extremity broadly rounded.

Male. Length 2 mm. Antennae as long as the body, sparsely white-haired, yellowish brown; 14 segments, the fifth with a stem as long as the cylindric basal enlargement, which latter has a length

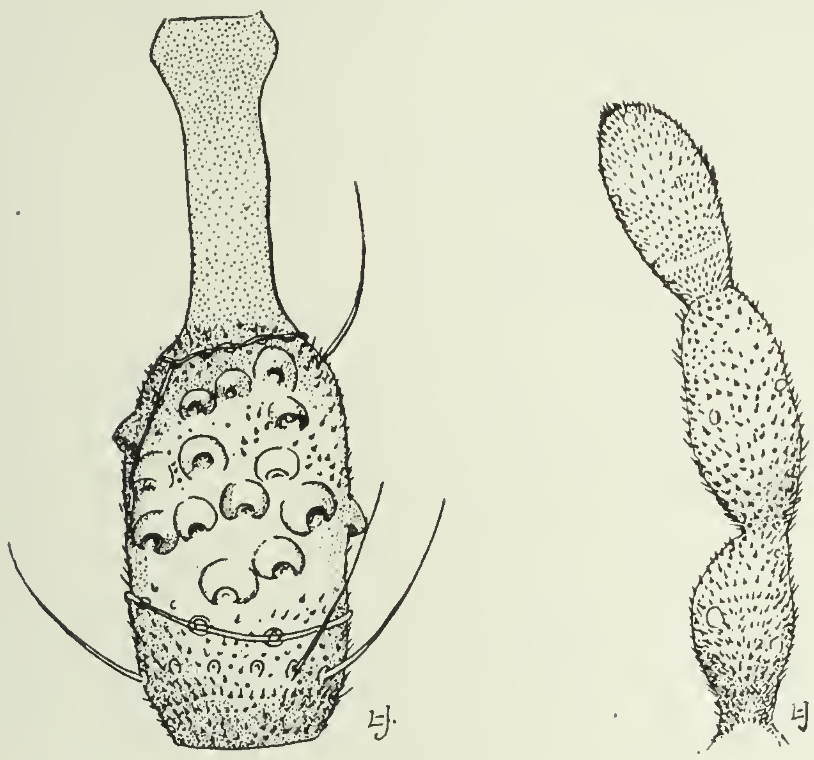


Fig. 50 Oligotrophus salicifolius; fifth antennal segment and palpus of male, enlarged (original)

twice its diameter; terminal segment reduced, narrowly rounded. Palpi; first segment narrowly oval, second one-half longer, slender, third a little shorter than the second. Mesonotum dark reddish, the median area dark brown, the submedian lines thickly haired. Scutellum reddish yellow, postscutellum fuscous. Abdomen sparsely haired, reddish yellow. Costa fuscous straw. Halteres long, yellowish basally, fuscous apically. Coxae fuscous yellowish; femora, tibiae and tarsi fuscous straw; claws slender, evenly curved, the pulvilli longer than the claws. Genitalia reddish brown; basal clasp segment stout; terminal clasp segment swollen, fuscous; dorsal plate long, triangularly emarginate; ventral plate broadly and roundly emarginate.

Female. Length 2.25 mm. Antennae extending to the base of the abdomen, sparsely haired, yellowish brown; 14 segments, the fifth with a length two and one-half times its diameter; terminal segment slightly reduced, tapering. Palpi nearly as in the male. Mesonotum dark reddish brown, submedian lines sparsely haired. Scutellum yellowish red, postscutellum reddish brown. Abdomen deep red. Costa fuscous straw. Halteres yellowish basally, fuscous apically. Coxae slaty brown, legs a variable fuscous straw. Ovipositor fuscous yellowish, as long as the abdomen; terminal lobe long, slender, tapering, narrowly rounded. Type Cecid. a2017.

Oligotrophus betheli Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20: 148

The midges were reared from a fleshy, apical gall on Juniperus utahensis collected by Professor Bethel at McCoy, Col.

Oligotrophus inquilinus Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 368
1909 ——— Ottawa Nat., 22: 247

This fuscous yellowish male was reared September 11, 1907, from a large, terminal rosette gall on Solidago, probably S. canadensis. Polygnotus sp. was reared from this midge.

Male. Length 3 mm. Antennae as long as the body, sparsely haired, yellowish brown; 16 segments, the fifth with a stem one-fourth longer than the basal enlargement, which latter has a length one-half greater than its diameter; terminal segment produced, tapering to a narrowly rounded apex. Palpi; first segment short, expanded distally, second narrowly oval, the third one-half longer, more slender. Mesonotum dark grayish brown, the submedian lines thickly haired. Scutellum dark reddish brown with numerous long setae apically, postscutellum reddish yellow. Abdomen fuscous yellowish, the segments rather thickly clothed dorsally and posteriorly with fuscous hairs; venter lighter. Genitalia yellowish brown, thickly haired. Costa reddish brown. Halteres fuscous yellowish, brown subapically. Legs a somewhat variable fuscous yellowish; claws slender, evenly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, terminal clasp segment short, swollen near the middle; dorsal plate short, deeply and triangularly emarginate; ventral plate short, deeply and triangularly emarginate. Harpes rather long, tapering. Type Cecid. a1655a.

RHOPALOMYIA Rubs.

1892 **Rubsaamen, E. H.** Berln. Ent. Zeitschr., 37: 328, 370
1895 **Kieffer, J. J.** Wien Ent. Zeit., 14: 9
1896 ——— Wien Ent. Zeit., 15: 89
1897 ——— Syn. Cecid. de Eur. & Alg., p. 21
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 362–63
1909 ——— Ent. Soc. Ont., 39th Rep't, p. 45
1910 **Rubsaamen, E. H.** Zeitsch. Wissenschaft. Insektenbiol., 15: 336
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19: 46
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 43

The American representatives of this genus have a very close general resemblance, being usually reddish brown, rather large insects. They vary widely in certain characteristics, the male antennae ranging in number from 23 segments down to 12 segments, and the stem of the fifth segment varying in length from about

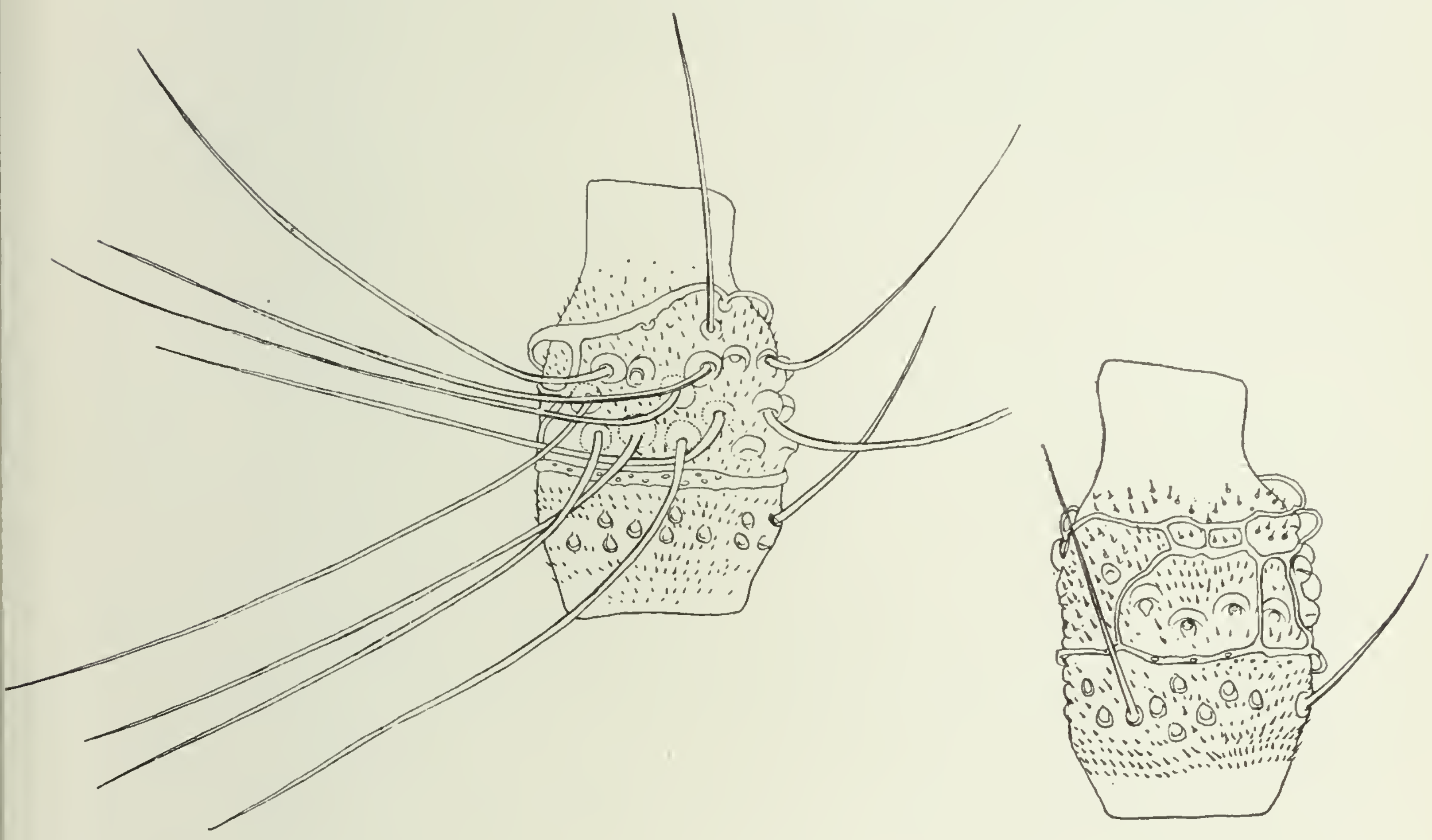


Fig. 51 Rhopalomyia species; two views of fifth antennal segment to show modifications in the circumfili, enlarged (original)

one-fourth longer than the basal enlargement to a stem only one-third the length of the basal enlargement. The segments of the female antennae vary in number from 25 to 13 and may have a stem one-third the length of the basal enlargement or be practically sessile. The palpi are uni- or bi-articulate. The male genitalia and the ovipositor of the female are quite characteristic of the genus, though approached in form by certain other genera. The general appearance of the wing is characteristic, the third vein uniting with the margin at or very close to the apex, while the distal third of the fifth vein is very faint (Plate 17,

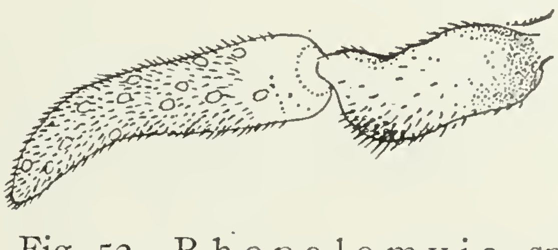


Fig. 52 Rhopalomyia sp.; female palpus, enlarged (original)

figure 3). The claws are invariably simple and the pulvilli usually as long or a little longer than the claws.

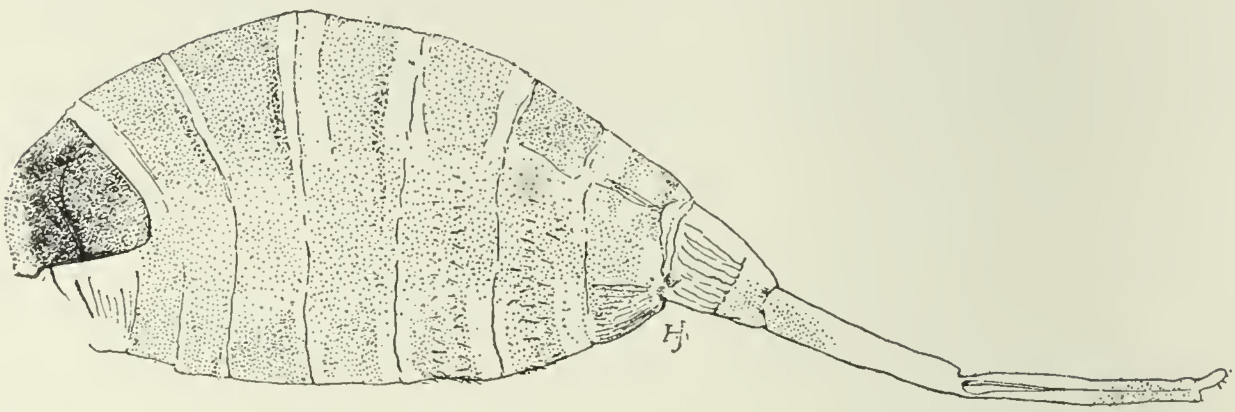


Fig. 53 Rhopalomyia sp.; lateral view of abdomen showing the extensile ovipositor, enlarged (original)

Species of Rhopalomyia show a marked preference for flower or bud galls, a very large proportion inhabiting deformed buds, among which may be classed the conspicuous apical rosette galls, the smaller flower or bud galls and reduced flower heads. A number also breed in leaf galls, such for example, as R. pedicellata and R. fusiformis, both of which inhabit a very characteristic type of gall which may appear on the stem, the leaf or in the flower head. It would appear that even this might originate while the tissues were in the bud and therefore most susceptible to injury. The well-known Rhopalomyia hirtipes produces a very characteristic gall at the apex of aerial or subterranean stems, the former being well known and the latter a recent discovery; both are in reality bud galls.

American members of this genus display a marked preference for Solidago, some sixteen species having been reared therefrom, while the closely allied aster supports four additional forms. Each species of this genus producing a gall on Solidago makes a characteristic deformity which appears to be correlated with marked structural differences in the adult and presumably by variations in habits.

Key to species

a Antennae with 20 or more segments

b 24 to 25 antennal segments; abdomen dark reddish brown; palpi biarticulate; female; reared from loose, rosette galls on Solidago canadensis
carolina Felt, C. a1635

bb 22 to 23 antennal segments

c Abdomen dark brown; legs dark brown; antennal stem one-fourth longer than the basal enlargement; palpi biarticulate; male
major Felt, C. 90

cc Abdomen reddish brown or brownish red; antennal stem in male three-fourths and in female one-third the length of the basal enlargement; reared from subglobular stem or rootstalk gall on Solidago
h i r t i p e s O. S., C. a1059, a1284

ccc Abdomen reddish yellow, stem of fifth antennal segment with a length one-half that of the basal enlargement. . u n i f o r m i s n. nom. C. 817

bbb 20 to 21 antennal segments

c Antennal stem one-fourth longer than the basal enlargement; abdomen fuscous yellowish; legs fuscous yellowish

d Palpi biarticulate, the basal enlargement with a length twice its diameter; male; reared from terminal rosette gall on Solidago
c a p i t a t a Felt, C. a1750

dd Palpi uniarticulate, basal enlargement with a length one-half greater than its diameter; male; reared from terminal rosette gall on Solidago. . . . . i n q u i s i t o r Felt, C. a1750a

cc Antennal stem as long as the basal enlargement

d Abdomen yellowish red; mesonotum reddish brown; wings narrow; antennae with 18 to 20 segments; male; reared from subglobular budlike gall on Solidago. . . . . r a c e m i c o l a O. S., C. a1605

dd Abdomen dark fuscous yellowish; mesonotum brown; wings broad; ventral plate deeply emarginate; male. . . . . a p i c a t a Felt, C. 529

ddd Abdomen dark brown; mesonotum dark brown; wings broad, ventral plate slightly emarginate; male; reared from subcylindric, pubescent bud gall on Solidago. . . . . . . a n t h o p h i l a O. S., C. 1039, a1608

ccc Antennal stem three-fourths the length of the basal enlargement

d Wings with whitish cast; abdomen fuscous yellowish; mesonotum dark brown; palpi biarticulate; male; reared from terminal rosette gall on Solidago. . . . . a l b i p e n n i s Felt, C. a1655

dd Wings hyaline; abdomen dark fuscous; mesonotum light brown; palpi uniarticulate; male; reared from fusiform leaf gall on Euthamia
f u s i f o r m i s Felt, C. a1150

cccc Antennal segments sessile; abdomen fuscous reddish brown; mesonotum yellowish brown; palpi biarticulate; female; reared from terminal rosette gall on Solidago. . . . . c a p i t a t a Felt, C. a1750, a1754

d Abdomen reddish orange; mesonotum yellowish brown; palpi uniarticulate; female; reared from axillary bud gall on Aster
l a t e r i f l o r i Felt, C. a1731

aa Antennae with 18 or 19 segments

b Antennal stem as long as the basal enlargement

c Abdomen reddish brown

d Palpi uniarticulate; male; bred from gall on Baccharis
c a l i f o r n i c a Felt., C. 1003, 983, 984

dd Palpi biarticulate; male; reared from stem gall on Baccharis
b a c c h a r i s Felt, C. 982

cc Abdomen fuscous yellowish; mesonotum reddish brown; palpi uniarticulate; male; reared from axillary bud gall on Aster
l a t e r i f l o r i Felt, C. a1731

ccc Abdomen dark brown, mesonotum reddish brown; probably from heads of Senicio or Aster. c o c k e r e l l i n. sp., a1931

cccc Abdomen yellowish red; mesonotum reddish brown; palpi biarticulate; male; reared from subglobular, budlike gall on Solidago
racemicola O. S., C. a1605

bb Antennal stem three-fourths the length of the basal enlargement

c Palpi biarticulate

d Abdomen brownish red; mesonotum dark red; male; reared from ovoid, fleshy, root stock gall on Solidago.....thompsoni Felt, C. 1100

dd Abdomen and mesonotum dark brown; reared from sessile galls on Aster branches..................crassulina Ckll., C. a1825

cc Palpi uniarticulate

d Antennae with 19 segments

e Abdomen dark brown; mesonotum reddish brown; male
abnormis Felt, C. 580

ee Abdomen dark fuscous; mesonotum light brown; male; reared from fusiform leaf gall on Euthamia....fusiformis Felt, C. a1150

dd Antennae with 18 segments

e Abdomen reddish brown; mesonotum reddish brown

f Basal enlargement of antennal segments with a length one-half greater than its diameter; lobes of dorsal plate truncate apically; male..........................truncata Felt, C. 1050

ff Basal enlargement of antennal segments with a length twice its diameter; lobes of dorsal plate rounded distally; male; reared from oval twig gall on Aster..astericaulis Felt, C. a1107

ee Abdomen dark reddish brown; mesonotum reddish brown; male; reared from fruit of Juniperus
Walshomyia juniperina Felt, C. 1049

eee Abdomen fuscous yellowish

f Mesonotum dark brown; reared from bulblike galls on Solidago
bulbula Felt, C. 1115

ff Mesonotum shining red; male; bred from axillary bud gall on Aster........................lateriflori Felt, C. a1731

eeee Abdomen yellowish brown; mesonotum reddish brown; male
pini Felt, C. 116

bbb Antennal stem with a length one-third the basal enlargement

c Abdomen fuscous yellowish; mesonotum fuscous yellowish; male; reared from stemmed, fusiform gall on Euthamia leaves or stems
pedicellata Felt, C. a1650, a1311

cc Abdomen dark reddish brown; mesonotum dark brown; female
palustris Felt, C. 1208

bbbb Antennal segments sessile or nearly so

c Palpi biarticulate

d 19 Antennal segments

e Abdomen and mesonotum reddish; female; reared from subcylindric, pubescent bud gall on Solidago
anthophila O. S., C. 1039, a1608

ee Abdomen reddish brown; mesonotum dark reddish brown; female; reared from stem gall on Baccharis..baccharis Felt, C. 982

dd 18 Antennal segments

e Abdomen dark carmine; mesonotum bright yellowish; scutellum pale yellow; female; reared from subglobular, budlike gall on Solidago
racemicola O. S., C. a1605

ee Abdomen and mesonotum dark brown or black; scutellum dark reddish brown; female; reared from ovoid, fleshy, root stock gall on Solidago......................thompsoni Felt, C. 1100

eee Abdomen deep reddish, mesonotum reddish brown; female; reared from Artemisia gnaphalodes
gnaphalodis Felt, C. 1382

cc Palpi uniarticulate

d Antennae with 19 segments

e Abdomen dark red; mesonotum reddish brown; legs fuscous yellowish; female; reared from stemmed, fusiform gall on Euthamia leaves or stems...............pedicellata Felt, C. a1650, a1311, 686

ee Abdomen dark brown; mesonotum reddish brown; legs dark brown; female; reared from subglobular stem gall on Euthamia
lobata Felt, C. a1647

eee Abdomen dark brown; mesonotum dark brown; tibiae and tarsi fuscous; female; reared from dwarf flower heads of Aster
asteriflorae Felt, C. a1757

eeee Abdomen fuscous yellowish; mesonotum yellowish brown; legs fuscous yellowish; female; reared from terminal rosette gall on Solidago.....................inquisitor Felt, C. a1750a

dd Antennae with 18 segments

e Abdomen reddish brown; mesonotum brown; legs dark brown; female; reared from fusiform leaf gall on Euthamia
fusiformis Felt, C. 843, a1150

ee Abdomen pale yellowish; mesonotum dark brown; legs fuscous yellowish; female; reared from bulblike galls on Solidago
bulbula Felt, C. 1115

eee Abdomen light brown; mesonotum dark brown; legs light brown; female; reared from gall on Bigelowia
bigelovioides Felt, C. 940

eeee Abdomen reddish brown; mesonotum dark reddish brown; legs light brown; female; reared from gall on Baccharis
californica Felt, C. 1003, 983, 984

aaa Antennae with 17 segments or less

b Antennae with 17 segments

c Antennal stem as long as the basal enlargement

d Abdomen fuscous yellowish; mesonotum fuscous yellowish; male; reared from woolly apical bud gall on ?Antennaria
pilosa Felt, C. 1215

dd Abdomen light brown; mesonotum shining brown; male; reared from flower galls on Solidago................cruziana Felt, C. 942

cc Antennal stem three-fourths the length of the basal enlargement

d Abdomen light yellowish; mesonotum light brown; male; reared from apical rosette gall on Euthamia........lanceolata Felt, C. 784

dd Abdomen fuscous yellowish; mesonotum dark reddish brown; reared from flower gall on Artemisia......betheliana Ckll., C. a1935

ccc Antennal stem one-third the length of the basal enlargement

d Abdomen light brown; mesonotum dark brown; female; reared from gall on Bigelowia................bigelovioides Felt, C. 940

dd Abdomen fuscous yellowish; mesonotum dark brown; female; reared from woolly apical bud gall on ? Antennaria. . p i l o s a Felt, C. 1215

cccc Antennal segments sessile or nearly so

d Abdomen and mesonotum reddish brown; scutellum reddish yellow; female; reared from fruit of Juniperus
W a l s h o m y i a j u n i p e r i n a Felt, C. 1049

dd Abdomen dull red; mesonotum and scutellum dark red; female; reared from very small, fusiform gall on Solidago leaves
c l a r k e i Felt, C. a1634

ddd Abdomen dark reddish; mesonotum dark brown; reared from apical flower gall on Artemisia. . . . . b e t h e l i a n a Ckll., C. a1935

bb Antennae with 16 segments

c Antennal stem with a length three-fourths that of the basal enlargement

d Abdomen dark reddish brown; mesonotum dark brown; male; reared from woolly bud gall on Antennaria. . a n t e n n a r i a e Whlr., C. 960

cc Antennal stems one-half the length of the basal enlargement

d Palpi biarticulate; reared from an oval, enlarged bud of Artemisia
t r i d e n t a t a e Rubs.

dd Palpi uniarticulate; reared from gooseberry buds
g r o s s u l a r i a e Felt, C. a2173

ccc Antennal stems one-third the length of the basal enlargement

d Abdomen dark reddish or yellowish brown; mesonotum brownish black; reared from woolly, globular gall on branches of Artemisia
a l t i c o l a Ckll., C. 768, a1353

cccc Antennal segments sessile or nearly so

d Abdomen dark reddish brown; mesonotum dark brown; female; reared from woolly bud gall on Antennaria. . . a n t e n n a r i a e Whlr., C. 960

bbb Antennae with 15 segments

c Antennal stem one-fourth longer than the basal enlargement

d Abdomen yellowish brown; legs dark brown; on Solidago; male
a r c u a t a Felt, C. 124

cc Antennal stems with a length three-fourths that of the basal enlargement

d Abdomen and mesonotum brown; palpi uniarticulate; male; reared from suboval flower or bud galls on Gutierrezia
g u t i e r r e z i a e Ckll., C. a1742

ccc Antennal segments sessile or nearly so

d Palpi biarticulate

e Abdomen light brown; mesonotum shining brown; female; reared from flower galls on Solidago. . . . . c r u z i a n a Felt, C. 942

dd Palpi uniarticulate

e Abdomen yellowish; mesonotum reddish brown; female; reared from apical rosette gall on Euthamia. . . . . . l a n c e o l a t a Felt, C. 784

ee Abdomen reddish or light yellowish brown; mesonotum reddish brown; female; reared from a hollow gall on Bigelowia
b i g e l o v i a e Ckll., C. 1070

bbbb Antennae with 13 to 14 segments

c Abdomen brownish red; mesonotum reddish brown; female; reared from suboval flower or bud gall on Gutierrezia
g u t i e r r e z i a e Ckll., C. a1742

cc Abdomen and mesonotum dark brown; female; reared from gall on Audibertia. . . . . a u d i b e r t i a e Felt, C. 1029

bbbbb Antennae with 12 segments
c Antennal stem with a length three-fourths that of the basal enlargement
d Abdomen and mesonotum dark brown; palpi uniarticulate; male; reared from gall on Audibertia......a u d i b e r t i a e Felt, C. 1029
dd Abdomen deep fuscous orange; palpi biarticulate; reared from petiole or bud gall on chestnut.............c a s t a n e a e Felt, C. a1716

Rhopalomyia crassulina Ckll.

1908 **Cockerell, T. D. A.** Can. Ent., 40: 89

This dark brown species was reared early in October 1907 from sessile galls on the branches of A s t e r c r a s s u l u s taken at Rydberg in Boulder, Col.

Gall. Length 7 mm, short, oval, " densely covered with white hair and appearing something like small, green peaches." These galls are sessile on the branches, often two placed side by side.

Male. Length 1.5 mm. Antennae three-fourths the length of the body, sparsely haired, dark brown; 18 segments, the fifth with a stem three-fourths the length of the basal enlargement, which latter has a length nearly twice its diameter; terminal segment produced, with a length about four times its diameter, tapering, obtuse. Palpi; the first segment short, stout, narrowly oval, with a length nearly twice its diameter, the second short, stout, broadly oval. Mesonotum dark brown, submedian lines sparsely haired. Scutellum and postscutellum yellowish. Abdomen dark brown, basally and the distal segment lighter; membrane and plurae yellowish. Genitalia fuscous. Wings hyaline, costa light brown; halteres pale yellowish. Legs mostly fuscous yellowish; femora darker apically, the tarsi somewhat lighter than the tibiae. Genitalia; basal clasp segment short, stout; terminal clasp segment very short, stout. Other organs indistinct in the preparation. Cecid. a1825.

Described from a specimen kindly contributed by Prof. T. D. A. Cockerell.

Rhopalomyia cockerelli n. sp.

Three males referable to this species were received February 16, 1908 from Prof. T. D. A. Cockerell of Boulder, Col. They are labeled: " September 29, on window, probably from heads of Senecio or Aster."

Male. Length 2 mm. Antennae about as long as the body, sparsely haired, dark brown; 19 segments, the fifth with a stem as long as the basal enlargement, the latter subglobose, with a length a little greater than its diameter; terminal segment produced, narrowly oval, with a length about three times its diameter. Palpi; one segment with a length over twice its diameter, tapering, narrowly rounded. Mesonotum reddish brown, the submedian lines fuscous yellowish, sparsely haired. Scutellum fuscous yellowish, with a

few coarse setae apically, postscutellum fuscous yellowish anteriorly. Abdomen sparsely clothed with long hairs, dark brown, the basal segment fuscous, the penultimate segment somewhat fuscous; genitalia yellowish. Wings hyaline, costa dark brown. Halteres yellowish basally, fuscous and whitish apically. Coxae fuscous yellowish, femora and tibiae lighter fuscous yellowish, tarsi mostly dark brown; claws stout, strongly curved, the pulvilli one-half longer than the claws. Genitalia; basal clasp segment stout; distal clasp segment short, greatly swollen, the insertion almost subapical; dorsal plate short, broad, broadly and triangularly emarginate; ventral plate long, broad, broadly and roundly emarginate. Harpes conspicuous, irregularly rounded. Type Cecid. a1931.

Rhopalomyia betheliana Ckll.

1909 **Cockerell, T. D. A.** Can. Ent., 41: 150-51

This species was reared March 30, 1909 from a flower gall of Artemisia frigida sent to us through the courtesy of Professor Cockerell from Denver, Col. Galls of this species on Artemisia filifera were also received from Prof. C. P. Gillette, Fort Collins, Col., in September 1909.

Gall. The gall is about 3 mm long, 2 mm broad, obpyriform, the apex truncate. It is pale yellowish with a fine, white tomentum.

Pupa. The pupa has been characterized by Professor Cockerell as a bright orange scarlet with a pair of prominent anterior projections.

Male. Length 2 mm. Antennae nearly as long as the body, sparsely haired, reddish brown; 17 segments, the fifth with a stem three-fourths the length of the basal enlargement, which latter has a length two and one-half times its diameter. Palpi; the one segment is stout, variably fusiform. Mesonotum shining dark reddish brown, the submedian lines sparsely haired. Scutellum shining dark brown, postscutellum reddish brown. Abdomen sparsely haired, a dull fuscous yellowish, the basal segment darker. Wings hyaline, costa light brown. Halteres yellowish basally, fuscous apically. Coxae dark brown. The legs a nearly uniform light fuscous yellowish; claws rather stout, evenly curved, the pulvilli nearly as long as the claws. Genitalia; basal clasp segment stout; terminal clasp segment short, greatly swollen near the basal third; dorsal plate long, broad, deeply and triangularly emarginate, ventral plate long, truncate. Harpes narrow, narrowly rounded.

Female. Length 2 mm. Antennae extending to the third abdominal segment, sparsely haired, yellowish brown; 17, sometimes 16, segments, the fifth sessile, cylindric, with a length three times its diameter, the terminal segment reduced, narrowly oval or fused with the preceding. Palpi as in the male. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum dark reddish brown, postscutellum dark brown. Abdomen sparsely haired, dark reddish, the ovipositor yellowish. Halteres whitish basally

pale orange distally. Legs nearly uniform pale yellowish brown, the pulvilli shorter than the strongly curved claws. Ovipositor about one-half the length of the abdomen, the terminal lobe stout, with a length only a little greater than its width. Type Cecid. a1935.

Rhopalomyia clarkei Felt

1907 **Felt, E. P.** New Species of Cecid. II, p. 18
1908 ———— N. Y. State Mus. Bul. 124, p. 299, 367
1909 ———— Ottawa Nat., 22:248

This species was reared October 8, 1907 from a very small, fusiform, pale green gall occurring mostly on the underside of the terminal leaves of Solidago rugosa and taken by Miss Cora H. Clarke at Tamworth, N. H. A few galls of apparently the same species were received from Miss Clarke from Magnolia, Mass. Similar galls were also sent September 20, 1907 by Mr T. D. Jarvis of Ontario, Canada, and taken by him on Solidago canadensis. We took this gall on Solidago canadensis at Asheville, N. C., September 29, 1906.

Gall. This is a minute, fusiform, greenish, or purplish-striped, frequently ribbed gall arising from the underside of the leaf about midway between the midrib and the edge. It is only about 1.6 mm long, a variable greenish and dark brown and sparsely clothed with rather coarse, whitish hairs. See plate 16, figure 1 and also New York State Museum Bulletin 175, plate 1, figure 21 and 21a for illustrations.

Male. Length 1.75 mm. Antennae about as long as the body, sparsely haired, dark brown; 19 segments, the fifth with a stem three-fourths the length of the basal enlargement, which latter has a length about twice its diameter; terminal segment reduced, narrowly oval and slightly fused with the preceding. Palpi; one slender, irregular segment with a length about four times its diameter. Mesonotum dark reddish brown, the submedian lines sparsely haired. Scutellum reddish orange, postscutellum yellowish. Abdomen rather thickly haired, dark brown, the distal segments lighter. Wings hyaline, costa reddish brown. Halteres yellowish basally, light fuscous apically. Coxae and femora basally pale yellowish, the distal portion of femora and tibiae yellowish straw; tarsi a variable reddish or fuscous yellowish. Claws slender, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, obtusely rounded; terminal clasp segment long, tapering; dorsal plate broad, deeply and triangularly incised; ventral plate long, broadly rounded apically. Harpes short, broad, truncate.

Female. Length 2 mm. Antennae about two-thirds the length of the body, sparsely haired, fuscous yellowish, basal segment and face fuscous; 17 segments, the fifth with a stem one-fifth the length of the basal enlargement, which latter has a length two and one-half times its diameter; terminal segment produced, tapering, obtuse.

Palpi; one irregularly fusiform segment with a length about two and one-half times its diameter. Mesonotum shining dark brown, the submedian lines sparsely haired. Scutellum dark red, postscutellum fuscous. Abdomen dull red, the small dorsal sclerites somewhat fuscous, membrane and pleurae deep reddish orange, ovipositor fuscous yellowish. Wings hyaline, costa fuscous straw. Halteres yellowish basally, fuscous subapically, dull orange apically. Legs a variable fuscous yellowish. Ovipositor as long as the abdomen, the terminal lobes long, stout, narrowly rounded. Otherwise practically as in the male. Type Cecid. a1634.

Rhopalomyia carolina Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 363
1909 ——— Ottawa Nat., 22: 247

This species was reared from large, loose, leafy heads on Solidago canadensis taken at Asheville, N. C., September 17, 1906, the adult appearing October 5th.

Gall. The deformed head produced by this species is about 11 cm in diameter and 3 cm high. It is composed of a number of smaller heads united in one large bunch. The free edges of many of the leaves project above the more solid mass by half to three-fourths of their length.

Female. Length 6 mm. Antennae extending to the second abdominal segment, sparsely haired, dark red; 24 to 25 segments,

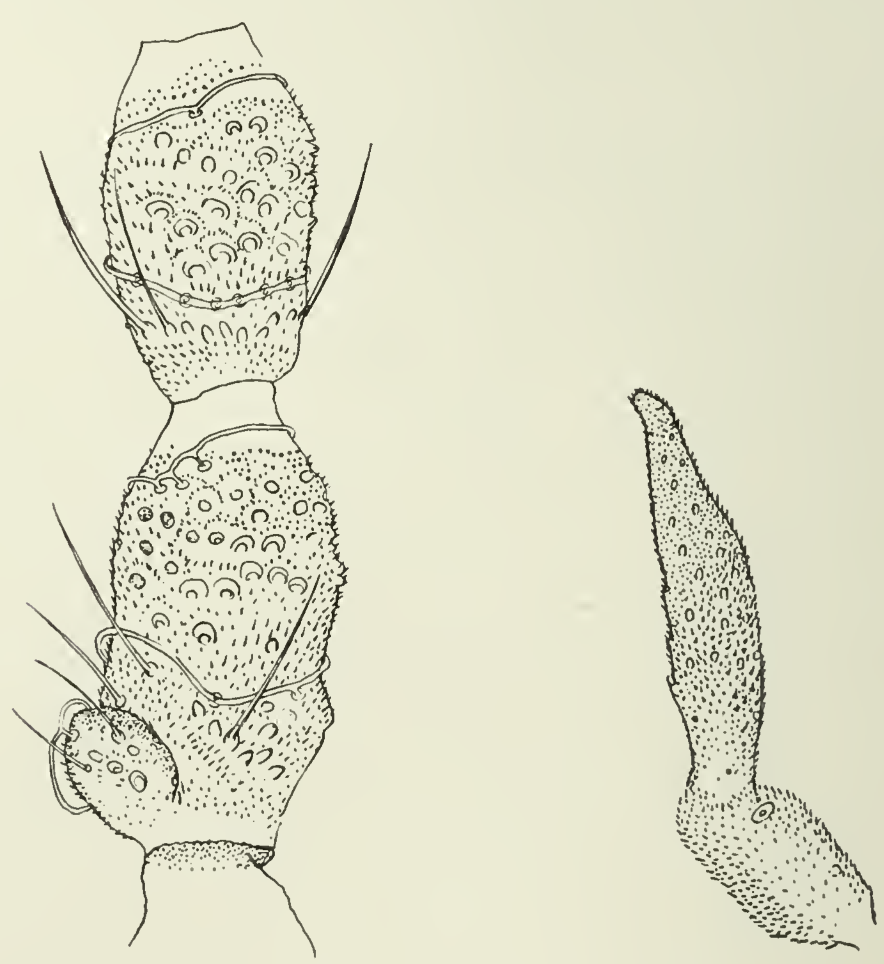


Fig. 54 Rhopalomyia carolina; two antennal segments, showing a rudimentary one at the base of the lower, and palpus enlarged (original)

the fifth subfusiform, sessile. Palpi; the first segment stout, subcylindric, second more slender, fusiform and about twice the length of the first; face reddish brown. Mesonotum reddish brown with submedian lines marked by distinct ridges, the area between distinctly lighter. Scutellum reddish brown, thickly clothed with coarse, black setae, postscutellum reddish brown. Abdomen dark reddish brown, the dorsal sclerities thickened and darker than the incisures or pleurae. Ovipositor pale yellowish red, the extreme tip reddish brown. Wings subhyaline, unspotted, costa dark brown; halteres pale orange basally, dark brown apically. Coxae, femora and tibiae a variable dark brown, tarsi reddish brown, the segments narrowly annulate distally with dark brown, basal seg-

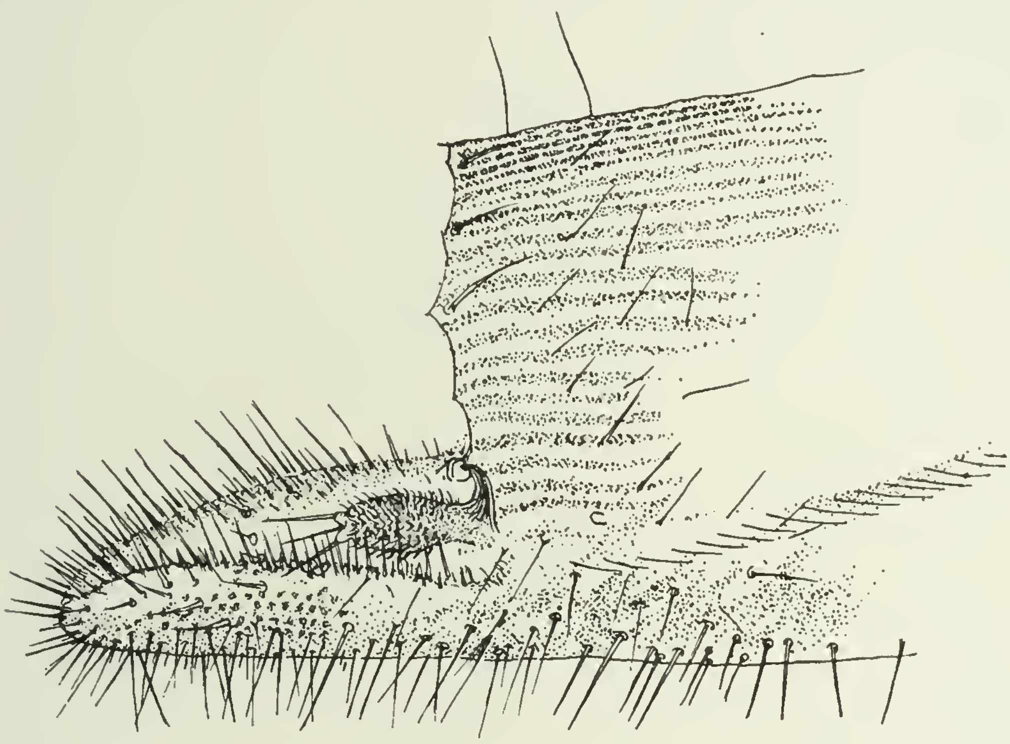


Fig. 55 Rhopalomyia carolina; lateral view of the tip of the ovipositor, enlarged (original)

ments of the posterior tarsi mostly dark brown; claws very heavy, evenly curved. Ovipositor long, the lobes roundly tapering. Type Cecid. a1635.

Rhopalomyia major Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 121 (separate p. 25)
1908 ———— N. Y. State Mus. Bul. 124, p. 363

This rather large species was taken May 31, 1906 in a trap lantern at Huguenot Park, N. Y.

Male. Length 4 mm. Antennae longer than the body, thickly white-haired, dark brown; 22 to 23 segments, the fifth with a stem one-fourth longer than the basal enlargement; terminal segment reduced, suboval. Palpi; the first segment stout, elongate, oval, the second a little longer, much more slender; face yellowish brown. Mesonotum dark brown, distinct submedian lines with fuscous hairs, similar hairs on the lateral margin. Scutellum yellowish brown, postscutellum yellowish brown, fuscous laterally. Abdomen

yellowish brown, rather thickly clothed with long, fuscous hairs. Wings subhyaline, costa dark brown; halteres yellowish transparent at base, fuscous, apically. Legs brownish black, the femoro-tibio

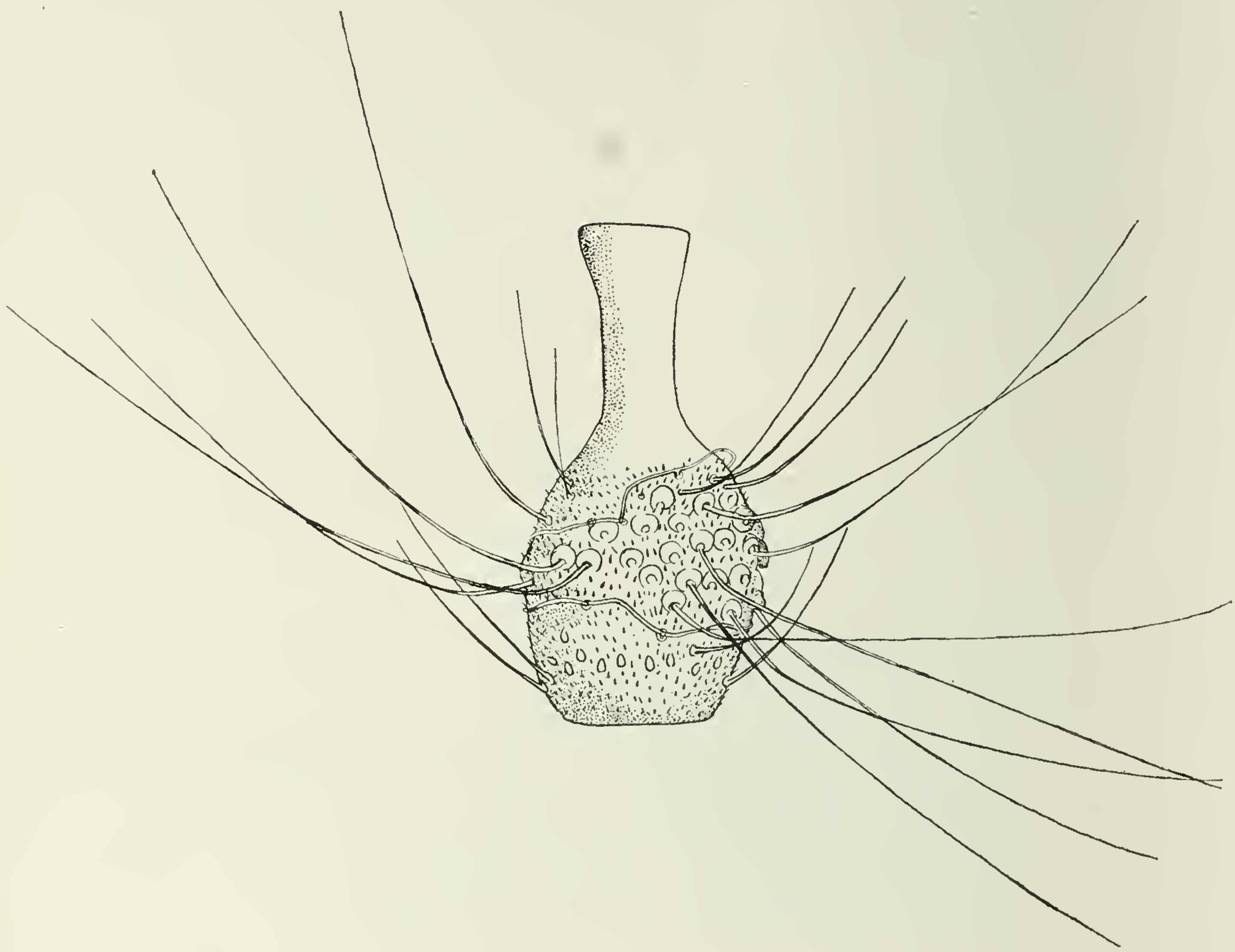


Fig. 56 Rhopalomyia major; fifth antennal segment of male, enlarged (original)

articulation tinged with reddish, tarsi dark brown; claws stout, slightly curved. Genitalia; basal clasp segment stout; terminal clasp segment very stout, short; dorsal plate broad, the lobes broadly rounded apically, obliquely truncate; ventral plate broad, deeply and roundly emarginate. Harpes strongly chitinized internally, with two heavy, chitinous bars, converging at each extremity, broadly rounded. (Plate 19, figure 1). Type Cecid. 90.

Rhopalomyia hirtipes O. S.

1862 **Osten Sacken, C. R.** Mon. Dipt. N. Amer. 1: 195 (Cecidomyia)
1905 **Felt, E. P.** N. Y. State Mus. Bul. 97, p. 410–11
1908 ———— N. Y. State Mus. Bul. 124, p. 363
1909 ———— Ottawa Nat., 22: 249
1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul. 2, p. 52
1913 **Beutenmuller, William.** Canad. Ent., 45: 413–14 (Dasyneura)

The species has been accounted somewhat rare in New York State though observations in September 1909 showed that under

certain conditions it might be exceedingly abundant. The normal type of gall, namely, the aerial apical deformity, is comparatively rare. On the other hand, the enlargements it produces on buds starting from root stocks and rarely extending above the surface of the ground, may be exceedingly common. In either case the gall usually splits open much in the same way as the husks of a hickory nut, allowing the reddish brown adults to escape from the somewhat fibrous, polythalamous interior. The flies appear in New York the latter part of August or early in September. Oviposition takes place a day or two after emergence, according to the observations of Miss Cora H. Clarke of Boston, Mass., the eggs being deposited promiscuously in a breeding jar containing the insects. Should this prove to be a normal habit of the species in the open, the insect must winter as very young larvae in rudimentary galls.

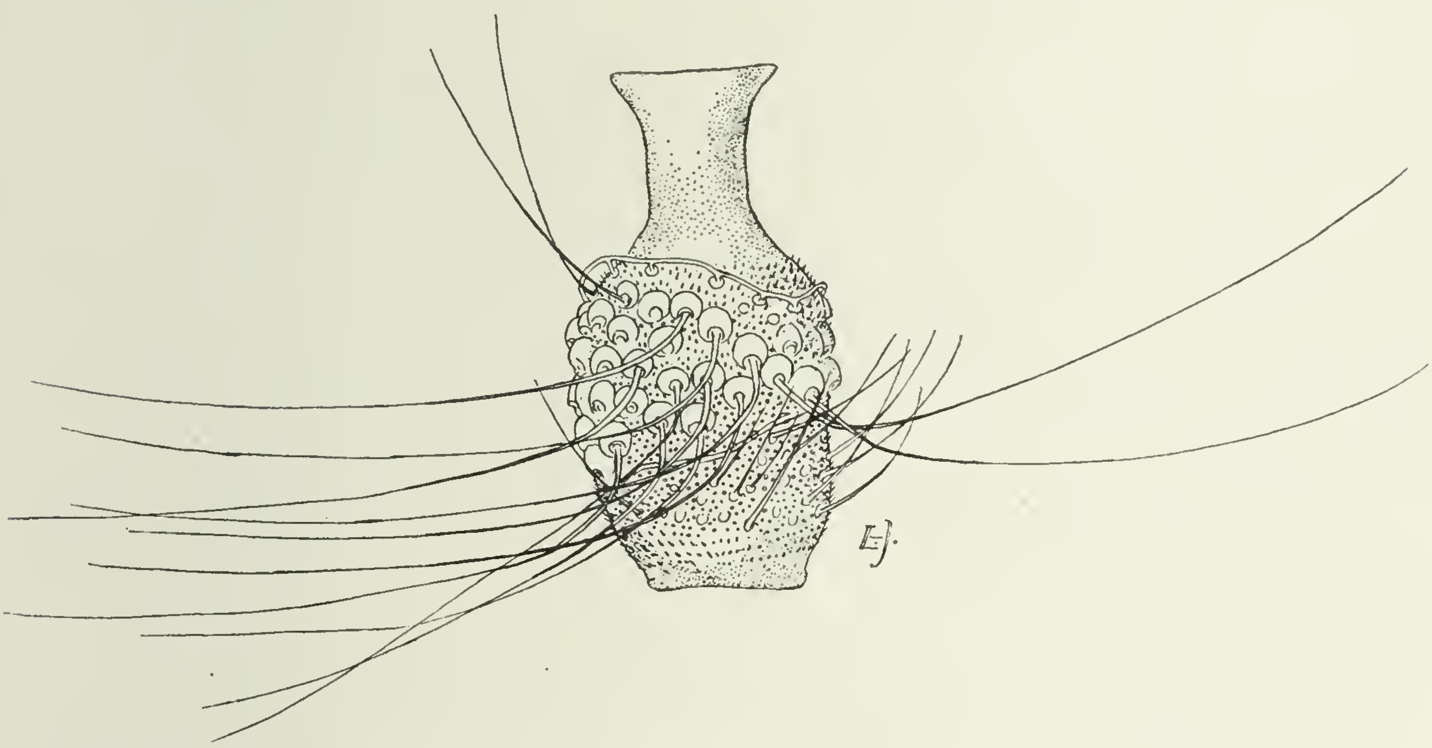


Fig. 57 Rhopalomyia hirtipes; fifth antennal segment of male, enlarged (original)

The galls of this species have been taken at Elizabethtown, N. Y., in numbers in and about Albany, N. Y., and at Springfield and Magnolia, Mass. The gall of apparently this form was received from Mr L. H. Weld of Evanston, Ill.

Gall. The aerial, better known type of gall has a diameter of 2.5 cm. It is smooth, brownish on the outside, the interior filled with a white pithy substance containing several larvae. The type of gall found at or just below the surface of the ground and evidently developing from root stock buds, varies greatly in size, ranging from about .5 to 2.5 cm in diameter. It may be globular or subglobular and has an interior similar to that described above. This

type of gall may occur in clusters about the base of the stems of Solidago juncea. (Plate 9, figures 1, 2. Plate 12, figure 2). See New York State Museum Bulletin 97 for a description of the midge, and Museum Bulletin 175, plate 4 figure 11, for a colored illustration of this gall. The male genitalia are illustrated on Plate 19, figure 2.

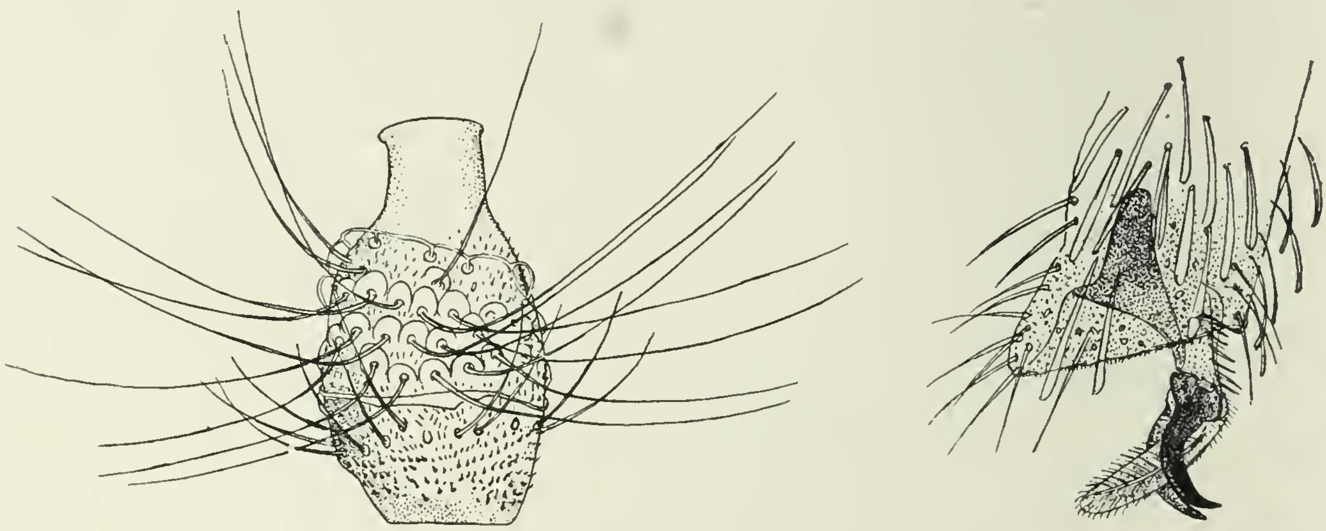


Fig. 58 Rhopalomyia hirtipes; fifth antennal segment of female, and claw with the apex of the tarsus, enlarged (original)

Rhopalomyia uniformis n. nom.

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 160–61 (Hormomyia truncata)

This large midge, closely allied to R. hirtipes O. S., though probably distinct therefrom, was taken by Mr J. G. Jack near Boston, Mass.

Male. Length 3 mm. Antennae nearly as long as the body, thickly haired, pale yellowish; 23 segments, the fifth with a stem one-half the length of the basal enlargement; terminal segment hardly reduced. Palpi; first segment subquadrate, with a length one-fourth greater than its diameter, the second probably twice the length of the third, tapering. Mesonotum a nearly uniform dark reddish brown, submedian lines indistinct. Scutellum yellowish red, postscutellum slightly yellowish basally, reddish yellow distally. Abdomen thickly clothed with long, fuscous hairs, reddish yellow, the genitalia dark orange. Halteres yellowish basally, fuscous apically. Legs a variable dark brown and reddish yellow, the distal tarsal segments mostly reddish yellow; claws slender, evenly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment stout, distinctly lobed, terminal clasp segment long, slender, hardly swollen; dorsal plate broad, broadly and roundly emarginate; ventral plate tapering, roundly truncate, both setose. (Plate 18, figure 3). Type Cecid. 817.

Rhopalomyia capitata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 363, 364
1909 ———— Ottawa Nat., 22: 247

This rather large species appears to be quite abundant in some localities. It seems to have a pronounced gregarious habit judging from the large number of galls on limited patches of Solidago serotina and S. canadensis. The galls attain full development from the middle till the latter part of September, the insects appearing in considerable numbers shortly thereafter, as many as 62 being reared in one day from a lot of galls. A Tachinid, Dichaetaneura leucoptera Johns., determined by its describer, was reared September 7, 1906 from this gall and presumably from this species.

Gall. The terminal rosette galls produced by this species are about 2.5 cm in diameter and composed of numerous small cells, each surrounded by a few leaflets about one-fourth the normal size and the entire mass is provided with a calyxlike whorl of longer leaflets. The length of the leaflets around the individual cells and the mass appears to be very naturally correlated with the degree of infestation, since the more populous heads have shorter leaflets. The individual galls occur at the base of the deformity among the leaflets, are somewhat conical in shape, about 4 mm high, 2 mm in diameter and not very unlike the gall of R. racemicola. See plate 10, figure 2; plate 13, figures 1, 2, and also New York Museum Bulletin 175, plate 1, figure 1, for a colored illustration.

Male. Length 2.5 mm. Antennae as long as the body, sparsely

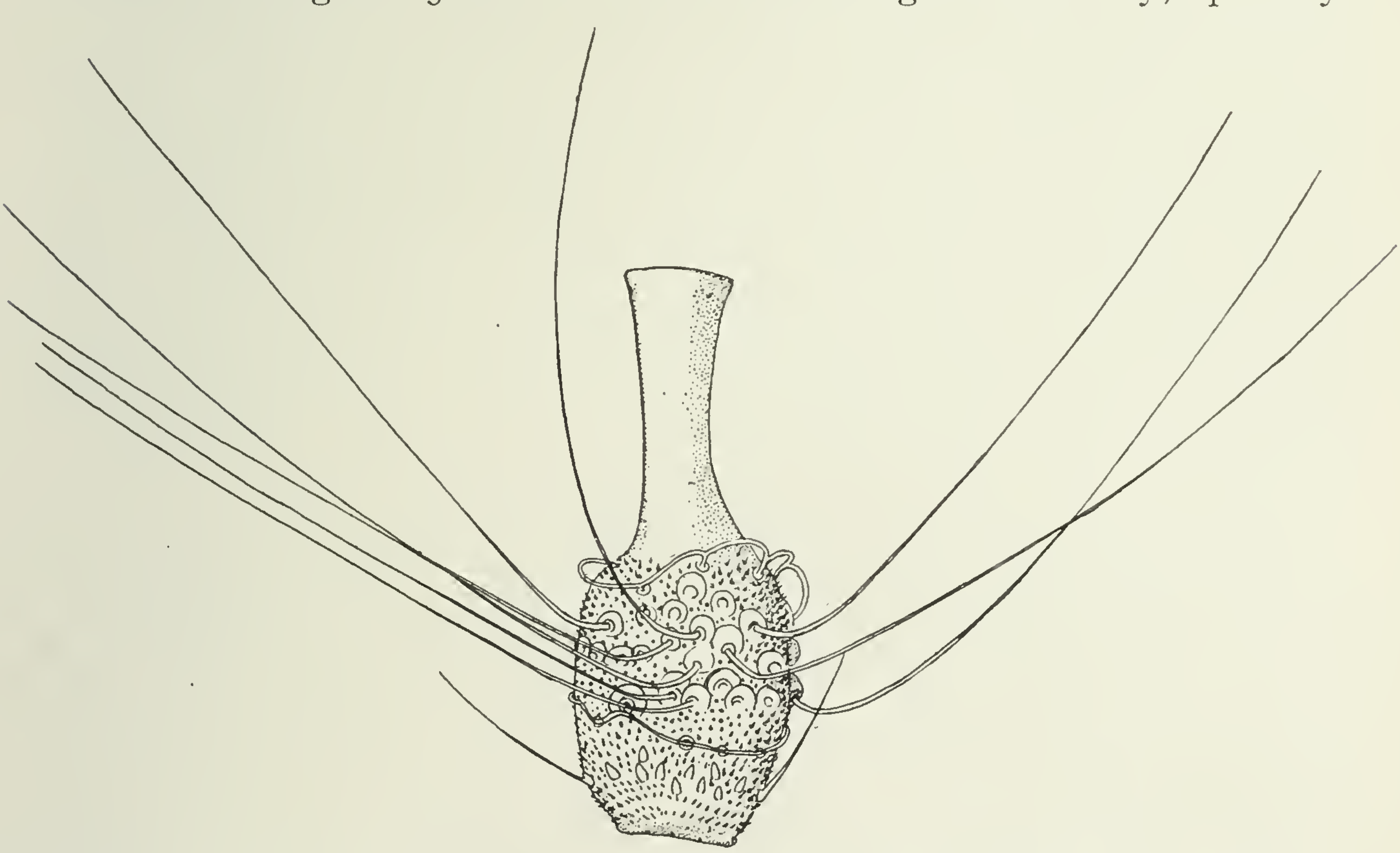


Fig. 59 Rhopalomyia capitata; fifth antennal segment of male, enlarged (original)

haired, pale or fuscous yellowish; 20 segments, the fifth with a stem one-fourth longer than the basal enlargement, which latter has a length nearly twice its diameter and tapers at both extremities; terminal segment produced, subcylindric, tapering, obtuse. Palpi; the first segment short, stout, subquadrate, with a length about one-half greater than its diameter, the second long, stout, about three times the length of the first. Mesonotum reddish brown, the submedian lines thickly haired. Scutellum reddish brown with numerous long setae apically, postscutellum fuscous. Abdomen fuscous yellowish, thickly haired. Wings hyaline, costa light brown. Halteres yellowish basally, fuscous apically. Legs a variable fuscous yellowish, the distal tarsal segments usually lighter; claws long, slender, evenly curved, the pulvilli about as long as the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment short, stout, greatly swollen basally; dorsal plate short, broad, apparently broadly rounded; ventral plate long, narrow, narrowly rounded. Harpes stout, narrowly rounded, convolute.

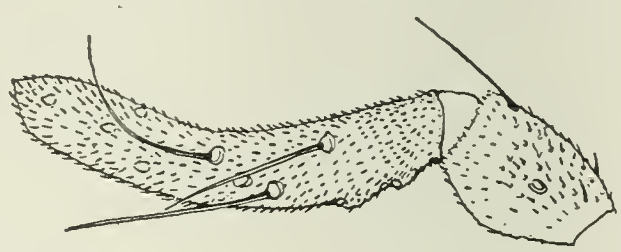


Fig. 60 Rhopalomyia capitata; male palpus, enlarged (original)

Female. Length 3 to 4 mm. Antennae extending to the fourth abdominal segment, sparsely haired, reddish brown; 21 segments, the fifth subsessile, with a length about twice its diameter; terminal segment partly fused with the preceding, reduced, conical. Palpi; the first segment short, stout, subquadrate, with a length about twice its diameter, the second more than twice the length of the first, tapering at both extremities and thickly clothed with stout setae. Mesonotum yellowish brown, the submedian lines thickly haired. Scutellum reddish brown, postscutellum fuscous salmon. Abdomen fuscous reddish brown, the incisures and pleurae reddish salmon; ovipositor fuscous yellowish. Wings hyaline, costa dark brown. Halteres yellowish basally, fuscous apically. Coxae and base of femora reddish yellow, distal portion of femora, tibiae and tarsi brown or black; the pulvilli longer than the claws. Ovipositor about two-thirds the length of the abdomen, the terminal lobes narrowly oval. Type Cecid. a1750.

Rhopalomyia solidaginis Loew.

1862 **Osten Sacken, C. R.** Mon. Dipt. N. Am., 1: 194–95 (Dasyneura)

1874 **Glover, Townend.** MS Notes from My Journal, p. 68 (Cecidomyia)

1892 **Beutenmueller, William.** Am. Mus. Nat. Hist., 4: 271 (Cecidomyia)

1900 **Smith, J. B.** List Insects N. J., p. 620 (Cecidomyia)

1904 **Beutenmueller, William.** Am. Mus. Nat. Hist. Guide Leaflet 16, p. 31 (Cecidomyia)

1905 **Cook, M. T.** Dep't Geol. & Nat. Res., Ind., 29th Rep't, p. 842 (Cecidomyia)

1907 **Jarvis, T. D.** Ent. Soc. Ont., 37th Rep't, p. 68 (Cecidomyia)

1909 ——— Ent. Soc. Ont., 39th Rep't, p. 81 (Cecidomyia)

1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul., p. 50 (Dasyneura)

This gall appears to be very common in different parts of the country, though it is possible that several species of gall flies are responsible for the production of apparently identical vegetable deformities. The gall, as described by Doctor Loew, is a globular head 1½ to 2 inches in diameter, formed of hundreds of leaves, the exterior ones being only a little altered, the interior more and more narrow. This structure results from the coalescence of several deformed aborted twigs and at the tip of each is a single gall with a compartment, shaped some like a small seed and having in its interior a cavity widened a little below. Rhopalomyia capitata may prove to be a synonym of this species. Polygnotus species was reared from this or a very similar gall.

Rhopalomyia lateriflori Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 364, 365

This species produces galls in the axils of the leaves of Aster lateriflorus at Lake George. Midges were obtained September 6, 1907. Apparently the same gall was found at Annisquam, Mass., by Miss Cora H. Clarke (plate 14, figure 2). Polygnotus species was reared from this gall.

The axillary gall produced by this species is round or slightly irregular and ranges in size from that of a small pea to about 10 mm in diameter. The color is usually greenish, the tip being brown.

Male. Length 1.5 mm. Antennae as long as the body, sparsely haired, light brown; 18 segments, the fifth with a stem as long as the basal enlargement, which latter has a length one-half greater than its diameter; terminal segment produced, tapering, obtuse. Palpi; one stout segment, broadly rounded apically. Mesonotum shining reddish brown. Scutellum dark orange, postscutellum fuscous. Abdomen fuscous yellowish. Genitalia fuscous. Wings hyaline, costa light straw. Halteres yellowish basally, fuscous apically. Legs a variable light brown; claws long, slender, evenly curved, the pulvilli one-half longer than the claws. Genitalia; basal clasp segment long, slender; terminal clasp segment short, greatly swollen; dorsal plate long, broad, slightly and roundly emarginate; ventral plate long, broad, broadly and roundly emarginate. Harpes heavy, convolute, narrowly rounded.

Female. Length 3 mm. Antennae one-half the length of the body, sparsely haired, yellowish orange, fuscous orange basally; 20 segments, the fifth with a stem one-fifth the length of the basal enlargement, which latter has a length twice its diameter; femora, tibiae and tarsi dark brown or black. Ovipositor nearly as long as

the abdomen, the terminal lobes with a length twice the diameter, broadly rounded apically. Type Cecid. a1731.

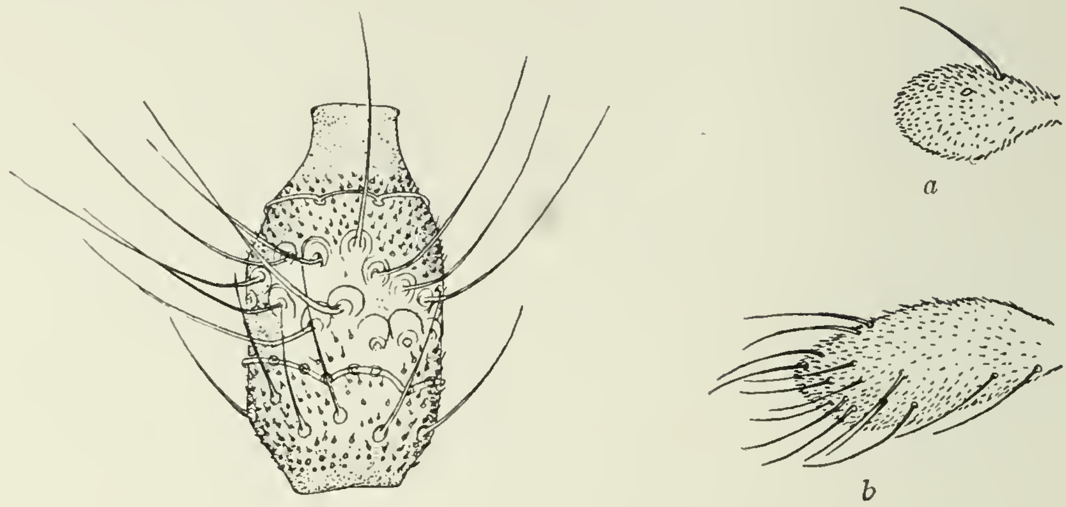


Fig. 61 Rhopalomyia lateriflori; fifth antennal segment of female; *a* male and *b* female palpus, enlarged (original)

Rhopalomyia inquisitor Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 364, 366
1909 ———— Ottawa Nat., 22: 247

This small form was reared from the same gall as that described under R. capitata Felt and it is presumably an inquiline. The species may possibly occur largely in the smaller galls comprising the large head or between the leaflets of the galls produced by R. capitata.

Male. Length 1.5 mm. Antennae as long as the body, sparsely haired, fuscous yellowish; 20 segments, the fifth with a stem one-fourth longer than the basal enlargement, which latter has a length one-half greater than its diameter; terminal segment produced,

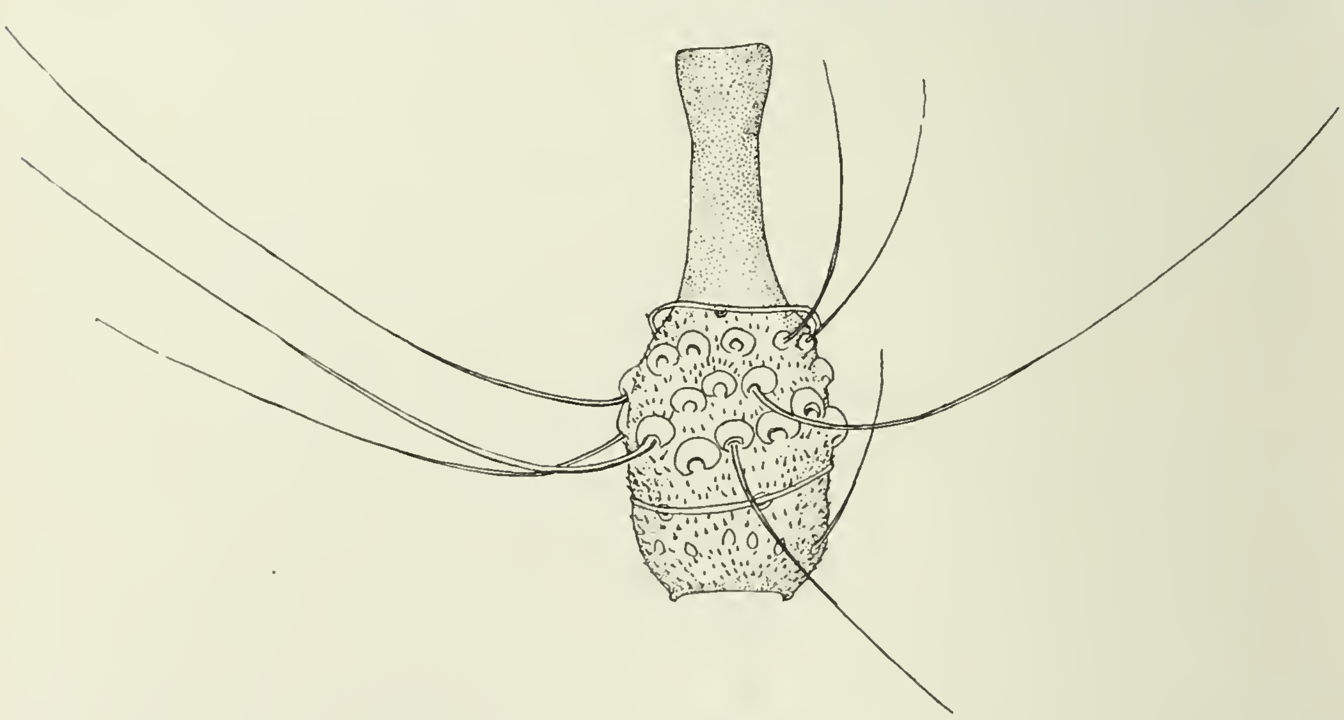


Fig. 62 Rhopalomyia inquisitor; fifth antennal segment of male, enlarged (original)

tapering, narrowly rounded. Palpi; one short, stout segment strongly constricted basally. Mesonotum shining yellowish brown, the submedian lines sparsely haired. Scutellum reddish brown, setose apically, postscutellum fuscous yellowish. Abdomen thickly haired, fuscous yellowish, the basal segments and genitalia fuscous. Wings hyaline, costa fuscous yellowish. Halteres yellowish basally, fuscous apically. Legs a variable fuscous yellowish; claws long,

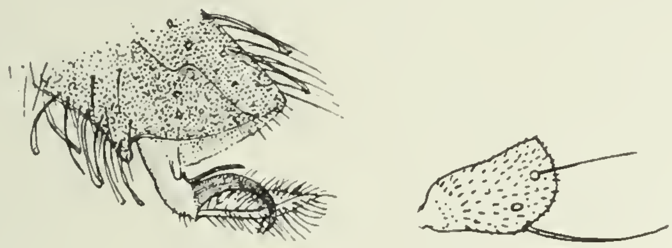


Fig. 63 Rhopalomyia inquisitor; lateral view of last tarsal segment (a) and claw, and male (b) palpus, enlarged (original)

slender, evenly curved, the pulvilli longer than the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment swollen; dorsal plate short, stout, broadly and triangularly emarginate; ventral plate long, broad, subtruncate. Harpes long, convolute, irregularly rounded.

Female. Length 2 mm. Antennae extending to the fourth abdominal segment, sparsely haired, pale yellowish; 19 segments, the fifth with a stem three-fourths the length of the basal enlargement, which latter has a length one-half greater than its diameter; terminal segment produced, tapering, acute. Palpi; one stout segment constricted basally. Ovipositor as long as the abdomen, the terminal lobes narrowly rounded. Other characters practically as in the male. Type Cecid. a1750a.

Rhopalomyia racemicola O. S.

1862 **Osten Sacken, C. R.** Mon. Dipt. N. Amer., 1: 196 (Cecidomyia)
1907 **Beutenmueller, William.** Amer. Mus. Nat. Hist. Bul. 23, p. 393–94
1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 120–21
1908 ———— N. Y. State Mus. Bul. 124, p. 364, 366
1909 ———— Ottawa Nat., 22: 246
1909 **Jarvis, T. D.** Ent. Soc. Ont., 39th Rep't, p. 81
1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul. 2, p. 50

The gall was first noticed by Osten Sacken in 1862 and subsequently the larva and gall were figured and described by Beutenmueller. The gall is rather common about Albany and Poughkeepsie, N. Y., and probably other places in New York State, on Solidago canadensis. Adults were reared in early October. Polygnotus and Torymus species were reared from this midge.

Gall. It is a rather firm greenish or reddish subglobular budlike enlargement about 2 mm in diameter and usually with a slight apical protuberance. See plate 15, figure 2, and also New York Museum Bulletin 175, plate 1, figure 2, for a colored illustration.

Male. Length 2.5 mm. Antennae as long as the body, sparsely white-haired, fuscous yellowish, some of the terminal segments reddish; 18 to 20 segments, the fifth with a stem as long as the basal enlargement; terminal segment reduced. Palpi; small, composed of a rather long, large basal segment and a little longer distal one. Mesonotum reddish brown, submedian lines yellowish, broad, rather thickly haired. Scutellum and postscutellum yellowish red. Abdomen yellowish red, thickly haired, basal segment somewhat fuscous; genitalia reddish; halteres yellowish basally, fuscous apically. Coxae fuscous yellowish, femora, tibiae and tarsi mostly variable reddish; claws stout, slightly curved. Genitalia; basal clasp segment short, greatly swollen at the basal third; dorsal plate broad, deeply emarginate; ventral plate broad, acutely rounded. Harpes stout, convolute, a quadrate, subapical spur.

Female. Length 2.5 mm. Antennae extending to the base of the abdomen, thickly white-haired, pale yellowish, reddish fuscous basally; 18 segments, the fifth twice as long as its diameter, the two distal segments frequently fused. Palpi; the first segment long, slightly expanded distally, second about equal to the first, swollen basally, tapering; face reddish fuscous. Mesonotum pale brownish yellow, submedian lines sparsely black-haired. Scutellum pale yellowish red, postscutellum fuscous yellowish. Abdomen dark carmine, the dorsum of the posterior segments yellowish; terminal segments pale salmon. Wings (Plate 17, figure 4) hyaline, costa dark brown; femora and tibiae dark fuscous; tarsi black; claws heavy, strongly curved. Ovipositor nearly as long as the body, the terminal lobes rather broad, rounded. Type Cecid. a1605.

Rhopalomyia apicata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 364

This species was taken in a trap lantern at Nassau, N. Y., July 7, 1906.

Male. Length 2.5 mm. Antennae about as long as the body, thickly haired, dark brown, basally fuscous, the stems semitransparent; 21 segments, the fifth with a stem as long as the basal enlargement, which latter has a length one-half greater than its diameter; terminal segment produced, tapering to an acute apex. Palpi; the first segment rather slender, with a length about two and one-half times its diameter, the second a little longer, acute distally; face fuscous. Mesonotum dark brown, the submedian lines yellowish, indistinct. Scutellum reddish brown, postscutellum yellowish brown. Abdomen dark fuscous yellowish, rather thickly clothed with short, fuscous hairs. Wings hyaline, costa light brown; halteres

pale yellowish. Legs a nearly uniform fuscous straw; claws long, slender, evenly curved, the pulvilli longer than the claws. Genitalia; basal clasp segment long, slender; terminal clasp segment short, stout, greatly swollen near the middle; dorsal plate short, broad, broadly and roundly emarginate; ventral plate long, tapering distally, broadly and roundly emarginate. Harpes convolute, narrowly rounded. Type Cecid. 529.

Rhopalomyia anthophila O. S.

1869 **Osten Sacken, C. R.** Amer. Ent. Soc. Trans., 2: 302 (Cecidomyia)

1892 **Beutenmueller, William.** Amer. Mus. Nat. Hist. Bul. 4, p. 272 (Cecidomyia)

1904 **Cook, M. T.** Ohio St. Univ. Bul. 17, p. 116

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 364, 365

1909 ———— Ottawa Nat., 22: 246

1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist., Bul. 2, p. 50

The gall of this species is quite different from that produced by R. racemicola, in that it is more or less cylindric and densely haired. This species appears to be much more local than R. racemicola, since a cluster of galls taken on Solidago canadensis at Asheville, N. C., September 16, 1906 was limited to one portion of a flower head, and careful searching failed to disclose any others in the near vicinity. Galls of this species were taken in the vicinity of Albany, N. Y., adults appearing about the middle of September. This midge was reared by the late Dr C. V. Riley in what he designates as seed pods of Solidago taken September 11, 1876 at Bushburg, Mo. Torymus sp. was reared from this midge.

Gall. The deformity is a transformed flower head about 6 mm long, 3 mm in diameter, pale green, densely pubescent, nearly cylindric, the tip being somewhat smaller than the base. Osten Sacken states that the inside of the gall is hollow, divided into two compartments by a delicate, funnel-shaped membrane placed near the middle of the cavity, point upward, the larva occurring at the bottom of the lower compartment. See Plate 15, figure 1, and also New York Museum Bulletin 175, plate 1, figure 3, for a colored illustration.

Male. Length 2.5 mm. Antennae as long as the body, sparsely haired, fuscous yellowish; 18 to 20 segments, the fifth with a stem as long as the basal enlargement, which latter has a length one-half greater than its diameter, tapering; terminal segment slender, with a length about three times its diameter, acute. Palpi; the first segment stout, subquadrate, with a length about one-half greater than its diameter, the second long, slender, over twice the

length of the preceding. Mesonotum dark brown, the submedian lines inconspicuous. Scutellum reddish brown, postscutellum fuscous

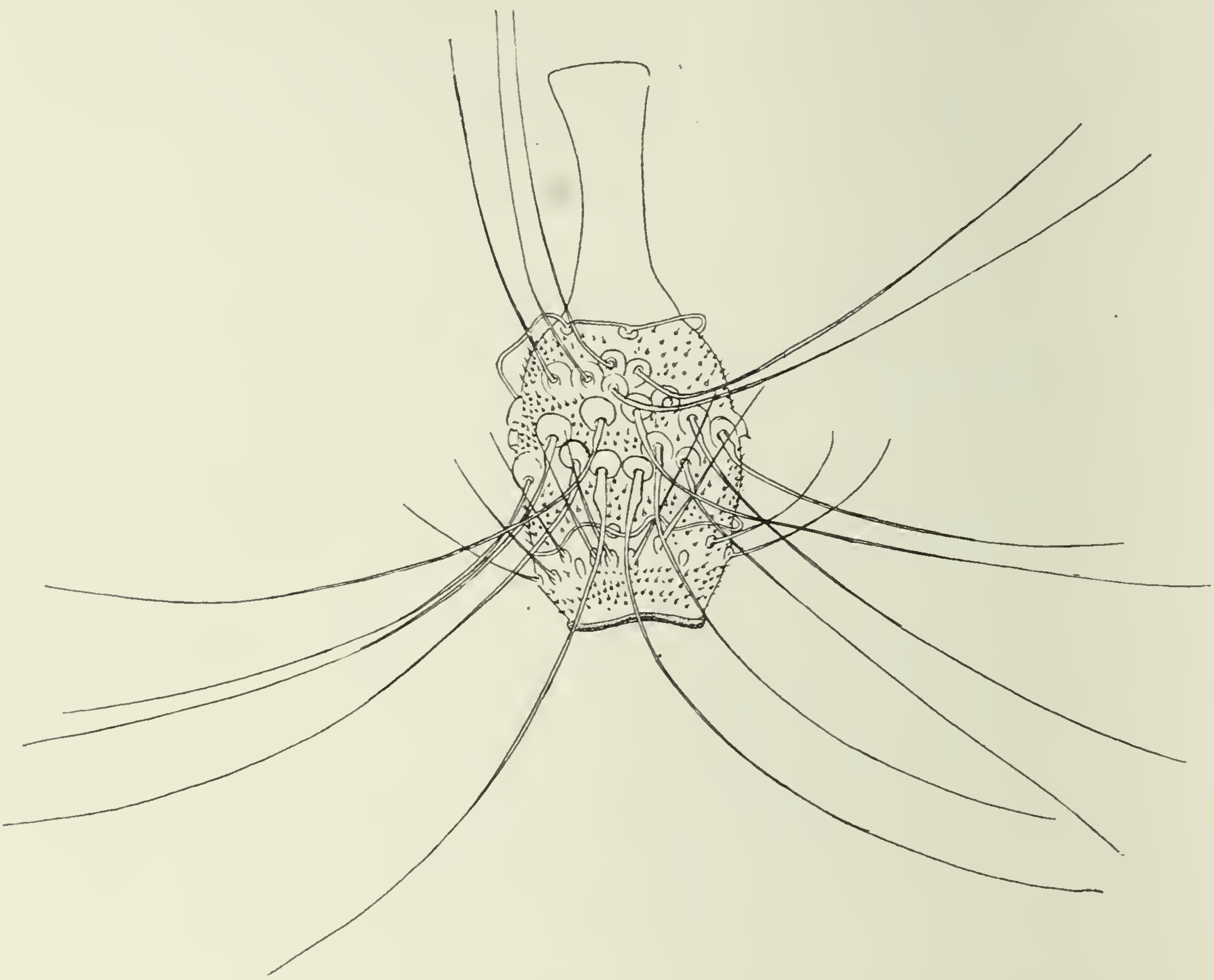


Fig. 64 Rhopalomyia anthophila; fifth antennal segment of male. enlarged (original)

yellowish. Abdomen thickly clothed with fine hairs, dark brown, the distal segments, genitalia and venter fuscous yellowish. Wings hyaline, costa light straw. Halteres yellowish basally, light fuscous apically. Legs a variable light straw, the distal tarsal segments somewhat lighter; claws long, slender, evenly curved, the pulvilli one-fourth longer than the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment short, stout, swollen near the basal third; dorsal plate short, stout, deeply and triangularly incised; ventral plate long, broad, broadly emarginate. Harpes broad, convolute, narrowly rounded, with two or three inconspicuous chitinous processes.

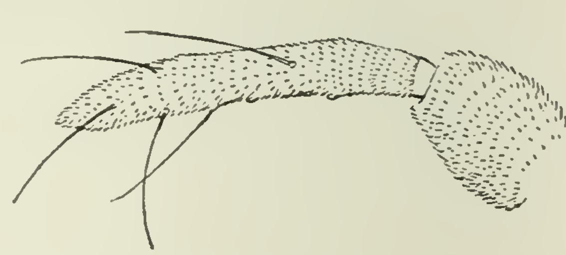


Fig. 65 Rhopalomyia anthophila; male palpus, enlarged (original)

Female. Length 3 mm. Antennae extending to the fourth abdominal segment, sparsely haired, pale yellowish or yellowish brown; 19 segments, the fifth with a length two and one-half times its diameter, tapering; terminal segment produced, tapering, narrowly

obtuse. Palpi; the first segment short, stout, irregularly subquadrate, the second stout, with a length about five times its diameter, setose. Mesonotum shining reddish brown, the submedian lines indistinct. Scutellum dark reddish brown, postscutellum dark orange. Abdomen pale orange or fuscous brown, the segments margined posteriorly with fuscous hairs. Ovipositor about as long as the body, the terminal lobes long, narrowly oval, subacute. Wing and other characters practically as in the opposite sex. Type Cecid. a1608.

Rhopalomyia albipennis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 364
1909 ———— Ottawa Nat., 22:247

This species was reared in numbers August 9–14, 1907 from a large, terminal rosette gall on Solidago canadensis collected at Albany, N. Y. Both white and reddish larvae were observed in the gall, which latter presents no marked difference from that of R. capitata. Polygnotus species was reared from this midge. The gall is illustrated on plate 4, figure 1.

Male. Length 4 mm. Antennae distinctly longer than the body, presumably thickly haired; 21 segments, the fifth with a stem three-fourths the length of the basal enlargement, which latter has a length one-half greater than its diameter and tapering at both extremities. Palpi; the first segment stout, with a length one-half greater than its diameter, the second slender, one-half longer than the first, acute apically. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum reddish brown, postscutellum fuscous yellowish. Abdomen thickly clothed with long setae, fuscous yellowish, the basal segments dark brown or black. Genitalia fuscous. Wings hyaline, costa light brown. Halteres yellowish basally, fuscous apically. Legs fuscous yellowish; claws long, stout, evenly curved, the pulvilli one-half longer than the claws. Genitalia; basal clasp segment short, stout; terminal clasp segment very short, stout, greatly swollen basally; dorsal plate short, broad, deeply and triangularly incised; ventral plate long, broad, deeply and narrowly incised. Harpes short, convolute, narrowly rounded.

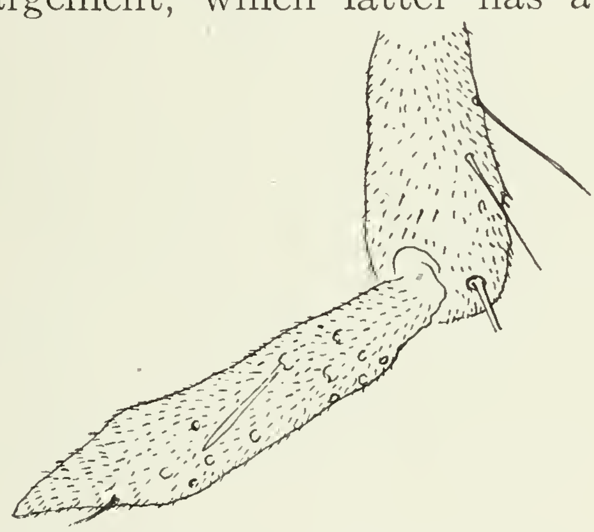


Fig. 66 Rhopalomyia albipennis; palpus, enlarged (original)

Female. Length 5 mm. Antennae extending to the fourth abdominal segment, sparsely haired, light brown; 21–22 subsessile segments, the fifth with a length twice its diameter and tapering at both extremities. Ovipositor one-half the length of the abdomen, the terminal lobes long, slightly constricted basally, roundly tapering, otherwise practically as in the male. Type Cecid. a1655.

Rhopalomyia fusiformis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 120 (separate, p. 24)
1908 ———— N. Y. State Mus. Bul. 124, p. 364, 365, 366
1909 ———— Ottawa Nat., 22: 247, 249

The galls of this species are rather common on the narrow-leaved Solidago, S. graminifolia, in midsummer, the adults appearing the latter part of July.

Gall. This is a peculiar ribbed, elongate structure about 6 mm long, occurring singly or in masses on the stem or the under or upper surface of the foliage. The color is usually very nearly that of the stem or leaf though it may have a dark reddish tint. The gall is slightly fusiform, it being a little enlarged above the circular base and then tapering to a rather fine, frequently slightly curved tip; the surface is usually strongly ribbed. Most of the galls arise from the stem, and in one unusual case a cluster of eight or ten galls occurred at the tip of an arrested stem. See New York State Museum Bulletin 175, plate 1, figure 5, for a colored illustration.

Larva. Length 3 mm, pale orange.

Male. Length 2 mm. Antennae as long as the body, sparsely haired, yellowish gray; 20 segments, the fifth with a stem two-

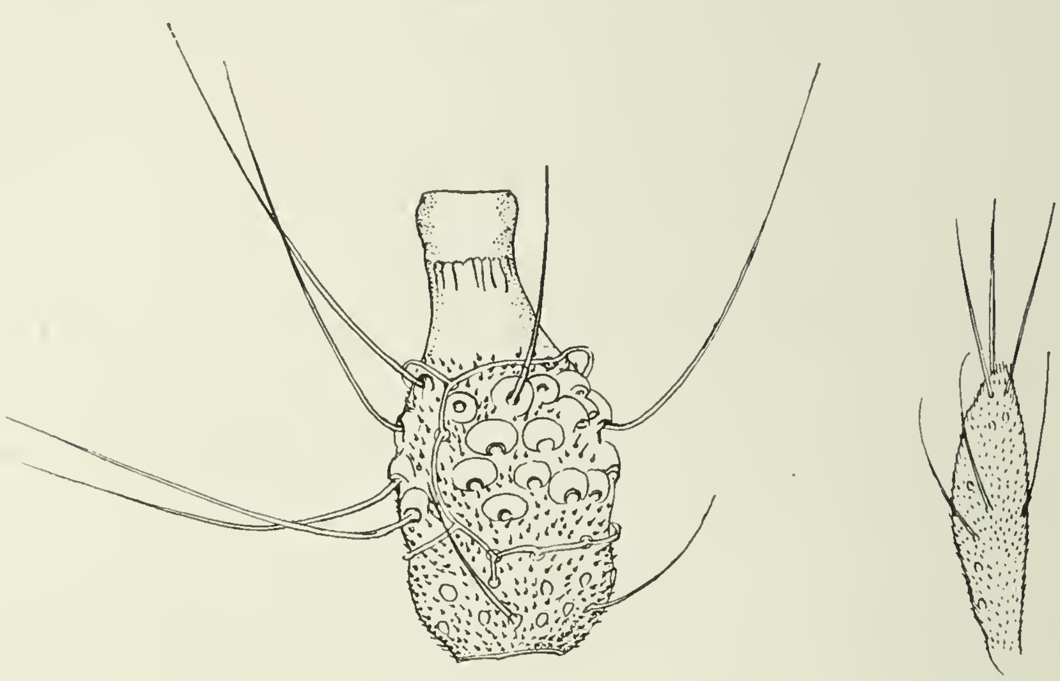


Fig. 67 Rhopalomyia fusiformis; fifth antennal segment of male and palpus, enlarged (original)

thirds the length of the basal enlargement. Palpi composed of one rather stout, elongate segment slightly enlarged at the distal third. Mesonotum light brown, submedian lines yellowish, uniting posteriorly in a median yellowish area. Scutellum fuscous yellowish with sparse apical setae, postscutellum yellowish brown. Abdomen dark fuscous yellowish, slightly darker basally, sparsely clothed with fine, fuscous hairs. Genitalia very dark. Wings (Plate 17, figure 3), subhyaline, costa yellowish brown; halteres pale yellowish basally, fuscous apically. Legs nearly uniform yellowish fuscous, distal tarsal segments sometimes variably tinged with pale

carmine; claws slender, strongly curved. Genitalia; basal and terminal clasp segments stout; dorsal plate broad, deeply incised; ventral plate broad, tapering, slightly emarginate. Harpes indistinct, the distal portion curved laterally, broadly rounded posteriorly.

Female. Length 3 mm. Antennae extending to the fourth abdominal segment, sparsely haired, pale yellowish, 18 segments, the fifth subsessile. Palpi; one long, slightly curved, irregular segment; face fuscous yellowish. Mesonotum brown, submedian lines fuscous yellowish. Scutellum fuscous yellowish, darker laterally with sparse median hairs, postscutellum dark brown. Abdomen reddish brown, incisures and pleurae reddish, dorsal sclerites thickly clothed with fine, ferruginous hairs; terminal segments yellowish. Wings subhyaline, costa dark brown; halteres yellowish transparent basally, fuscous apically. Legs nearly uniform dark brown; claws heavy, strongly curved, simple. Ovipositor moderately long, terminal lobes slender, broadly rounded.

Another female reared from this gall has the median mesonotal brownish stripe shorter than the sublateral ones. The scutellum has a patch of long, black setae on each side. The abdomen is sparsely clothed with coarse, black hairs. The halteres are dark to the basal third where there appears to be a tuft of black setae. Coxae whitish transluscent. Type Cecid. a1150.

Rhopalomyia californica Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 364, 366

This species was reared February 1, 1904 by Mr M. A. Knickerbocker from Baccharis and sent to the Bureau of Entomology, United States Department of Agriculture. Apparently the same species was taken in Alameda county, California, on B. pilularis in September, presumably in 1885, and others reared from the flowers of this plant April 25, 1886.

Male. Length 2 mm. Antennae about as long as the body, thickly haired, light yellowish brown, 18 or 19 segments, the fifth with a stem as long as the basal enlargement, which latter has a length one-half greater than its diameter and tapers somewhat at each extremity; terminal segment greatly produced, cylindric, with a length about four times its diameter, tapering, obtuse. Palpi; a single short, stout, segment, tapering at both extremities. Mesonotum dark reddish brown. Scutellum reddish brown and yellowish, postscutellum dark brown. Abdomen thickly, haired, reddish brown. Wings hyaline, costa light brown; halteres yellowish transparent. Legs a variable light brown; claws long, slender, evenly curved, the pulvilli longer than the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment long, slender; dorsal plate short,

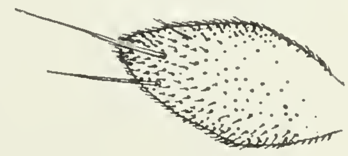


Fig. 68 Rhopalomyia californica; palpus, enlarged (original)

broad, deeply and triangularly incised; ventral plate broad at base, tapering, nearly truncate. Harpes long, convolute, narrowly rounded.

Female. Length 3 mm. Antennae extending to the fourth abdominal segment, sparsely haired, light brown; 18 segments, subsessile, the fifth with a length nearly three times its diameter, tapering at both extremities; terminal segment produced, with a length about two and one-half times its diameter, tapering, obtuse, sometimes partly fused with the preceding. Ovipositor about half the length of the abdomen, the terminal lobes long, slender, tapering, narrowly rounded. Other characters practically as in the opposite sex. Type Cecid. 1003.

Rhopalomyia baccharis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 364, 365

This form, closely related to the preceding, was reared December 17 to 23, 1885, from stem galls on B a c c h a r i s p i l u l a r i s.

Male. Length 2 mm. Antennae about as long as the body, rather thickly haired, light yellowish brown, presumably 19 segments, the fifth with a stem as long as the basal enlargement, which latter has a length one-half greater than its diameter. Palpi; the first segment rather stout, expanding distally, with a length over two times its diameter, the second longer than the first, tapering from its basal extremity to an acute apex. Mesonotum dark reddish brown. Scutellum reddish brown and yellowish, postscutellum dark brown. Abdomen rather thickly haired, reddish brown. Wings hyaline. costa yellowish brown. Halteres yellowish transparent. Legs a variable brown; claws long, slender, strongly curved, the pulvilli longer than the claws. Genitalia; basal clasp segment short, broad; terminal clasp segment short, stout, tapering; dorsal plate very short, broadly and triangularly emarginate; ventral plate broad at base, tapering, roundly emarginate. Harpes very broad, somewhat convolute, obliquely or roundly truncate, with a chitinous tubercle at the posterior internal angle.

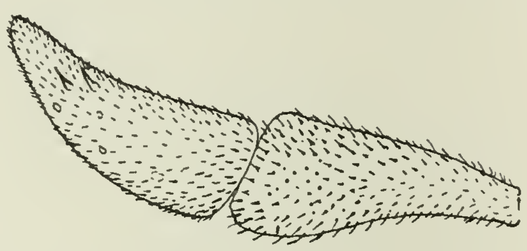


Fig. 69 R h o p a l o m y i a b a c c h a r i s; palpus, enlarged (original)

Female. Length 2.5 mm. Antennae extending to the fourth abdominal segment, sparsely haired, yellowish brown; 19 segments, subsessile, the fifth with a length about three times its diameter, the extremities somewhat rounded; terminal segment with a length about four times its diameter, tapering, subacute. Palpi; the first segment stout, roundly pyriform, the second stout, with a length three times its diameter, obtuse. Ovipositor about one-half the length of the abdomen, the terminal lobes long, slender, tapering, narrowly rounded. Type Cecid. 982.

Rhopalomyia thompsoni Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 159
1908 ———— N. Y. State Mus. Bul. 124, p. 365, 366
1909 ———— Ottawa Nat., 22:249

This species was collected and reared by the late Dr M. T. Thompson of Clark University, Worcester, Mass., from a globular or ovoid, fleshy gall on the root stock of Solidago, probably S. juncea.

Gall. The galls (plate 11, figure 2) have been described by Doctor Thompson as solitary or clustered, ovoid, fleshy, the flesh very spongy and easily torn with the fingers. The larval cells are thin with a scarcely perceptible wall vertically and one to eight occur in a gall. The growth of the plant lifts the gall above the surface of the ground, at which time its skin bursts and it becomes foliated.

Male. Length 2.5 mm. Antennae nearly as long as the body, sparsely haired, pale yellowish, the basal ones reddish, the distal segments tinged with reddish; 19 segments, the fifth with a stem

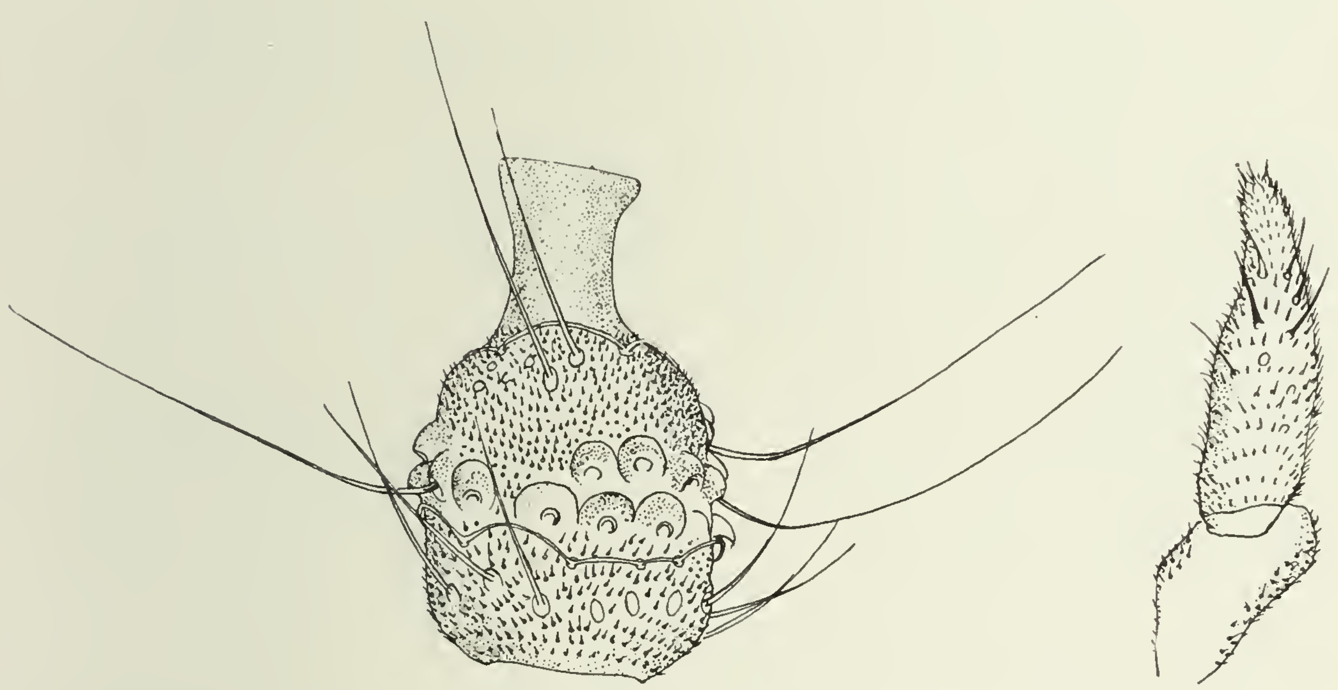


Fig. 70 Rhopalomyia thompsoni; fifth antennal segment of male and palpus, enlarged (original)

three-fourths the length of the basal enlargement, which latter has a length one-fourth greater than its diameter; terminal segment variable, usually narrowly oval. Palpi; the first segment rather indistinct, subquadrate, the second long, tapering, slightly curved. Mesonotum dark reddish, submedian lines sparsely clothed with fine setae. Scutellum pale salmon, postscutellum dark brown. Abdomen a deep brick red with heavy bands of black scales, genitalia fuscous. Wings hyaline, costa reddish brown. Halteres yellowish transparent. Legs mostly black, the coxae and base of femora a variable yellowish; claws long, strongly curved, the pulvilli longer than the claws. Genitalia; basal clasp segment long, stout, with a

conspicuous lobe at the internal distal angle; terminal clasp segment long, stout, swollen near the middle; dorsal plate very broad, short, broadly and triangularly emarginate; ventral plate long, broad, deeply and triangularly emarginate.

Female. Length 4 mm. Antennae extending to the third abdominal segment, sparsely haired, yellowish, the distal and basal segments tinged with red; 18 segments, the fifth subsessile, with a length about twice its diameter; terminal segment produced, narrowly oval. Palpi; the first segment rather stout, irregularly subquadrate, the second obconic, curving, acute; face fuscous. Mesonotum dark brown or black, submedian lines indistinct. Scutellum a dark reddish brown, postscutellum fuscous. Abdomen a very dark brown or black, the incisures a deep intense red; costa dark brown. Legs mostly black, the coxae and base of femora yellowish; claws rather long, strongly curved. Ovipositor nearly as long as the abdomen, the terminal lobes long, slender, irregularly rounded. Type Cecid. 1100.

This may prove to be a small form of R. hirtipes O. S.

Rhopalomyia abnormis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 365

The male described under this name was taken in a trap lantern at Huguenot Park, N. Y., July 14, 1906. Nothing is known concerning its life history.

Male. Length 2 mm. Antennae about as long as the body, sparsely haired, dark brown; 19 segments, the fifth with a stem as long as the basal enlargement, which latter has a length a little greater than its diameter, rounded at the extremities; terminal segment produced, narrowly rounded. Palpi; one long, slender segment, swollen near the middle, irregularly curved and tapering, subacute. Mesonotum reddish brown. Scutellum reddish, postscutellum yellowish brown. Abdomen dark brown, thickly clothed with fine hairs. Wings hyaline, costa light brown; halteres pale reddish. Legs a nearly uniform dark brown; claws long, slender, evenly curved, the pulvilli longer than the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment long, swollen near the middle; dorsal plate short, broad, deeply and triangularly incised; ventral plate long, tapering, roundly emarginate. Harpes long, broad, convolute, irregularly rounded.

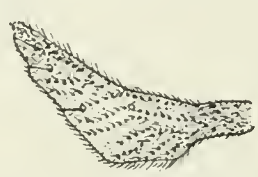


Fig. 71 Rhopalomyia abnormis; palpus, enlarged (original)

This specimen has a number of the terminal segments of one antenna fused to form a long, uniform mass with a length approximately six times its diameter; the apex narrowly rounded. Type Cecid. 580.

Rhopalomyia truncata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 365

This species was taken at Los Angeles, Cal., by Mr D. W. Coquillett. It is numbered 162.

Male. Length 2.25 mm. Antennae extending to the fourth abdominal segment, thickly haired, fuscous yellowish; 18 segments, the fifth with a stem three-fourths the length of the basal enlargement, which latter has a length one-half greater than its diameter; terminal segment reduced, narrowly oval. Palpi; one short, rather slender segment having a length about twice its diameter. Thorax and abdomen a nearly uniform dark brown. Mesonotum and scutellum a nearly uniform dark reddish brown, the latter with a few coarse setae apically, postscutellum and abdomen a nearly uniform dark reddish brown, the latter thickly clothed with long, yellowish setae. Wings hyaline, costa light brown. Halteres yellowish basally, fuscous apically. Legs pale yellowish straw; claws long, slender, evenly curved, the pulvilli longer than the claws. Genitalia; basal and terminal clasp segments short, stout; dorsal plate long, broad, deeply and triangularly emarginate; ventral plate long, broad, broadly and slightly emarginate. Harpes short, stout, convolute, obliquely truncate. Type Cecid. 1050.

Rhopalomyia astericaulis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 159
1908 ———— N. Y. State Mus. Bul. 124, p. 365

This species was reared by the late Dr M. T. Thompson of Clark University, Worcester, Mass., from an oval, twig gall on aster. A specimen was secured at Wood's Holl, Mass., the flies issuing

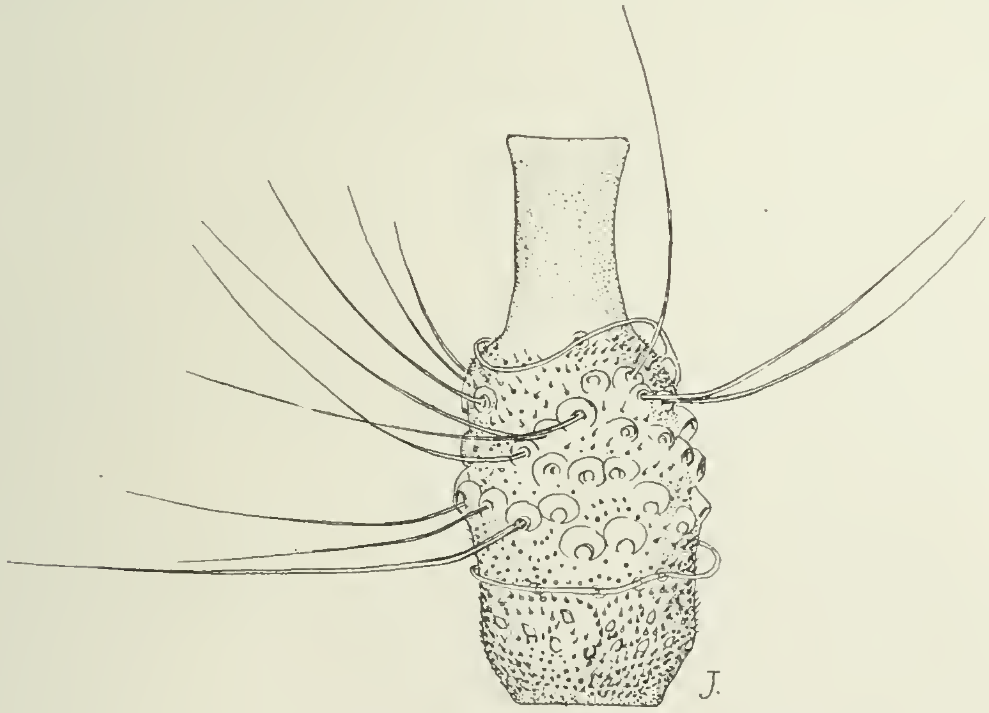


Fig. 72 Rhopalomyia astericaulis; fifth antennal segment of male, enlarged (original)

July 13th. Doctor Thompson states that these aster galls are special favorites with inquilines, and adds that he has nearly always found two distinct larvae in the stem gall of Aster novae-angliae. The insect obtained most abundantly from this gall was determined as Neolasioptera ramuscula Beutm. It is possible that the Rhopalomyia is an inquiline, since it occurred in very small numbers.

Male. Length 2.5 mm. Antennae probably extending to the fourth abdominal segment, sparsely haired, dark brown; 18 segments, the fifth with a stem three-fourths the length of the basal enlargement, which latter has a length twice its diameter; terminal segment with the basal portion produced, narrowly oval, acute distally. Palpi; a single rather stout, fusiform segment. Mesonotum reddish brown, darker laterally, the submedian lines thickly clothed with long hairs. Scutellum fuscous yellowish, postscutellum yellowish. Abdomen reddish brown with the segments margined posteriorly with long hairs. Wings hyaline, costa dark brown; halteres whitish transparent basally, fuscous apically. Legs a variable dark brown; claws slender, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment long, greatly swollen; dorsal plate very short, broad, slightly, broadly and triangularly emarginate; ventral plate long, stout, subtruncate or slightly emarginate. Harpes stout, the dorsal margin strongly chitinized, irregularly rounded. Type Cecid. c1107a.

Rhopalomyia bulbula Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 365, 366
1909 ———— Ottawa Nat., 22:249

The gall of this species occurs on goldenrod near the ground, it resembling very much small bulblets attached to the side of the plant. It was collected and midges reared by the late Dr M. T. Thompson of Clark University, Worcester, Mass., who states that the flies appear very similar to those of R. thompsoni, though they are paler and less hairy. It may prove identical with R. hirtipes O. S.

Gall. The gall is about 6 mm long, 2.5 mm in diameter, irregularly cylindric, slightly curved and usually green with darker stripes. It is clustered at the surface of the ground and is a typical budlike growth. (Plate 11, figure 1.)

Male. Length 2.5 mm. Antennae as long as the body, sparsely haired, pale yellowish; 18 segments, the fifth with a stem about three-fourths the length of the basal enlargement, which latter tapers basally and apically, has a length about one-half greater than its diameter; terminal segment slightly reduced, broadly oval. Palpi; probably one segment; face fuscous yellowish. Mesonotum dark brown, the rather distinct submedian lines and posterior median area yellowish.

Scutellum fuscous yellowish, postscutellum yellowish. Abdomen fuscous yellowish, sparsely clothed with fine hairs, genitalia darker. Wings hyaline, costa light brown; halteres whitish transparent. Legs a nearly uniform fuscous yellowish; claws long, slender, strongly curved, the pulvilli a little longer than the claws. Genitalia; basal clasp segment short, stout; terminal clasp segment long, stout; dorsal plate short, broad, apparently broadly rounded; ventral plate longer, tapering, broadly truncate. Harpes long, stout, excurved, narrowly rounded.

Female. Length 3 mm. Antennae extending to the sixth abdominal segment, sparsely haired, pale yellowish; 18 segments, the fifth with the basal enlargement having a length about twice its diameter; terminal segment prolonged, slightly constricted near the distal third, narrowly rounded. Palpi; a single stout, long, irregularly fusiform segment bearing a few coarse setae; face fuscous yellowish. Mesonotum dark brown, the submedian lines indistinct. Scutellum reddish brown, postscutellum pale yellowish, fuscous distally. Abdomen pale yellowish with the dorsal sclerites distinctly fuscous, almost dark brown, ovipositor pale orange or yellowish, probably nearly as long as the body, the terminal lobes long, broad, slightly constricted at the base, broadly rounded. Described from alcoholic specimens. Type Cecid. 1115.

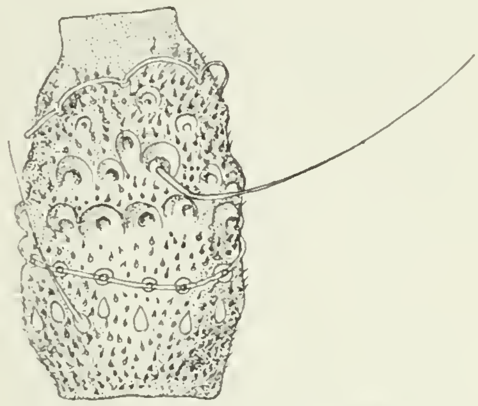


Fig. 73 Rhopalomyia bulbula; fifth antennal segment of female, enlarged (original)

Rhopalomyia pini Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 120 (separate, p. 24)
1908 ———— N. Y. State Mus. Bul. 124, p. 365

This species was taken at Albany, N. Y., June 4, 1906 flying to a white pine.

Male. Length 2.5 mm. Antennae probably nearly as long as the body, thickly white haired, light yellowish; 18 segments, the fifth with a stem three-fourths the length of the basal enlargement; terminal segment produced, suboval. Palpi: composed of one long, subquadrate segment, slightly expanded distally. Face dark brown. Mesonotum reddish brown, the submedian lines with slaty hairs. Scutellum yellowish brown, postscutellum reddish brown. Abdomen yellowish brown, thickly clothed with slaty hairs. Wings hyaline, costa dark brown. Halteres very long, slender, yellowish transparent basally, fuscous apically. Legs slaty brown; claws slender, uniformly curved. Genitalia; basal clasp segment long, stout; terminal clasp segment large, rounded, swollen at the distal third; dorsal plate broad, deeply and triangularly emarginate; ventral plate broadly rounded. (Plate 18, figure 2.) Harpes stout, broadly rounded. Type Cecid. 116.

Rhopalomyia gnaphalodis Felt

1911 **Felt, E. P.** Econ. Ent. Jour., 4: 484

This form was reared April 25–29, 1910 by Prof. T. D. A. Cockerell, Boulder, Col., from a woolly polythalamous gall on Artemisia gnaphalodes.

Gall. An irregular, lobulate, polythalamous swelling 1 cm in diameter and 1.3 cm long. The surface is irregularly wrinkled and thickly clothed with short, white pubescence.

Exuviae, protruding from a circular exit hole, whitish transparent.

Rhopalomyia pedicellata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 365, 366

1909 ———— Ottawa Nat., 22: 248, 249

1910 **Stebbins, F. A.** Springf. Mus. Nat. Hist. Bul. 2, p. 53 (Cecidomyia euthamiae Stebbins)

This species resembles R. fusiformis both in the form of the gall and the general appearance of the adult. The gall, however, is easily distinguished by the long stem or pedicel which is about one-half the length of the deformity. The galls occur on the narrow-leaved solidago, Solidago graminifolia, the earlier ones become fully developed about the middle of July and others may be found from that date to the end of the summer. This species is rather common in the vicinity of Albany.

Gall. The gall is about 2 cm long, the stem being .6 or .7 cm in length, while the slender, enlarged, fusiform portion is 1.3 to 1.4 cm long. The latter is strongly ribbed, deep purplish green at the tip. It frequently arises from the edge of the leaf, occasionally from the flat surface of either the leaf or stem. The interior walls are succulent when fresh, becoming mealy after drying. A single whitish larva some 3 mm long occurs in each gall. See New York Museum Bulletin 175, Plate 1, figure 6, for a colored illustration.

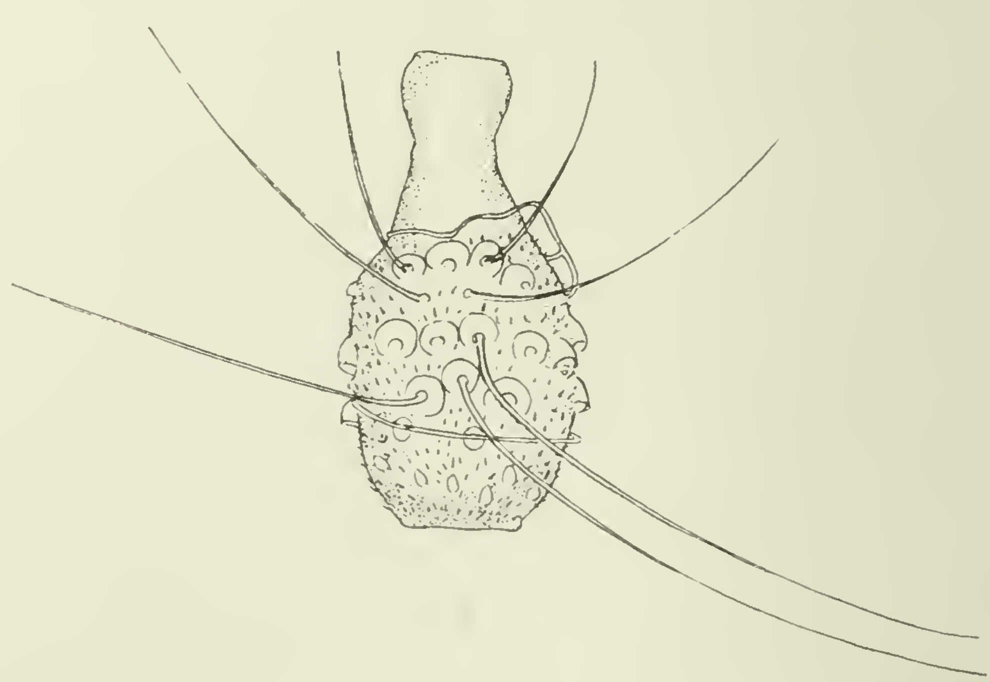


Fig. 74 Rhopalomyia pedicellata; fifth antennal segment of male, enlarged (original)

Male. Length 2 mm. Antennae nearly as long as the body, sparsely haired, light fuscous yellowish, the terminal and basal segments yellowish; 19 segments, the fifth with a stem one-third the length of the basal enlargement, which latter has a length one-half greater than its diameter; the two terminal segments rather closely fused, the distal one narrowly rounded. Palp; one rather long, slender, acute segment; face fuscous yellowish. Mesonotum dark fuscous yellowish, the submedian lines lighter, sparsely haired. Scutellum light fuscous yellowish with coarse setae apically, postscutellum darker. Abdomen rather thickly clothed with fuscous hairs, fuscous yellowish, the basal segments and genitalia somewhat darker. Wings hyaline, costa dark brown. Halteres yellowish basally, fuscous apically. Coxae, femora and tibiae mostly fuscous yellowish, tarsi a little darker; claws long, slender, strongly curved apically, the pulvilli a little longer than the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment long, stout; dorsal plate short, broad, deeply and triangularly emarginate; ventral plate long, tapering, broadly and roundly emarginate. Harpes broad, long, irregularly rounded.

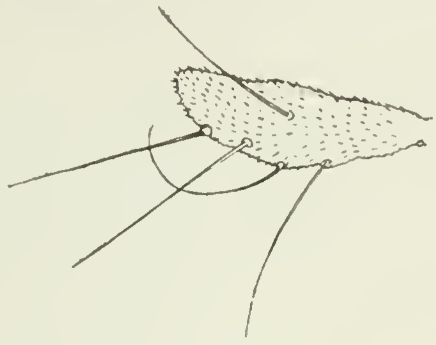


Fig. 75 Rhopalomyia pedicellata; male palpus, enlarged (original)

Female. Length 3 mm. Antennae extending to the fourth abdominal segment, sparsely haired, light fuscous yellowish, tinged with reddish apically; 18 or 19 segments, the fifth subsessile with a length two and one-half times its diameter; terminal segment greatly prolonged, obtusely rounded. Mesonotum reddish brown, the submedian lines yellowish, sparsely haired. Scutellum reddish yellow with numerous fuscous setae apically, postscutellum dark red. Abdomen thickly clothed with fuscous hairs, especially laterally, dark red, the incisures and pleurae yellowish red, ovipositor pale yellowish. Wings hyaline, costa dark brown. Ovipositor about as long as the abdomen, the terminal lobes long, tapering, narrowly rounded. Otherwise nearly as in the male.

Two females reared July 25th are distinctly darker than that described above, the antennae being reddish yellow, mesonotum shining dark red, submedian lines thickly haired. Scutellum and postscutellum a light reddish salmon, abdomen thickly clothed with fuscous hairs, the incisures and pleurae dark red. Legs nearly black. Type Cecid. a1650.

Rhopalomyia palustris Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 365

This female was taken by sweeping sweetflag at Nassau, N. Y., June 7, 1907.

Female. Length 2 mm. Antennae nearly as long as the body, sparsely haired, fuscous yellowish; 19 segments, the fifth with a stem one-third the length of the basal enlargement, which latter has a length about twice its diameter; terminal segment produced, narrowly oval. Palpi; one subfusiform segment having a length about three times its diameter; face fuscous. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum reddish brown, postscutellum dark brown. Abdomen a dark reddish brown, the fifth and sixth segments somewhat lighter, ovipositor pale orange. Wings hyaline, costa dark brown. Halteres yellowish basally, fuscous apically. Legs a nearly uniform fuscous yellowish; claws long, slender, slightly curved, the pulvilli longer than the claws. Ovipositor about two-thirds the length of the abdomen, the terminal lobes long, slender, irregularly rounded. Type Cecid. 1208.

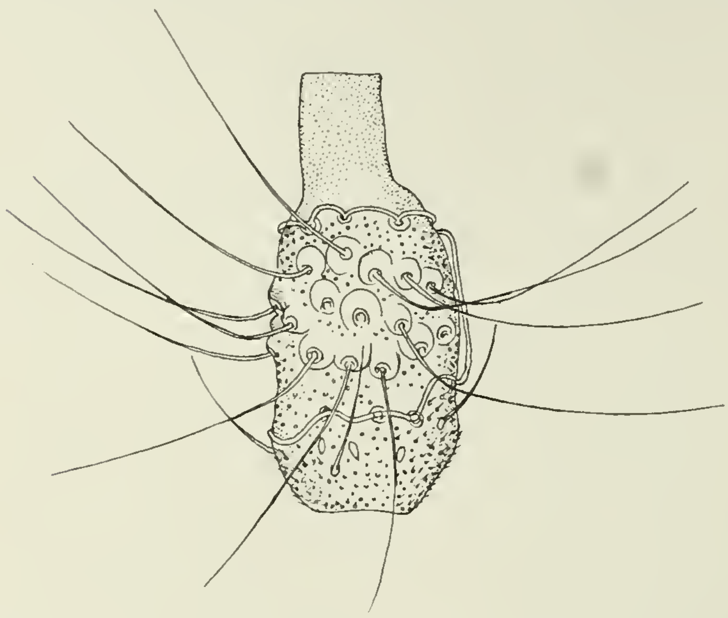


Fig. 76 Rhopalomyia palustris; fifth antennal segment of male, enlarged (original)

Rhopalomyia lobata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 366
1909 ———— Ottawa Nat., 22: 249

This species was reared July 17, 1907 from a subglobular gall occurring near the top of a slender stem of Solidago graminifolia taken at West Nyack, N. Y.

Gall. The gall is subglobular, inclosed in several whorls of distorted leaflets or bracts and about 1.5 cm in diameter. The interior is composed of spongy material inhabited by several larvae.

Female. Length 3.5 mm. Antennae extending to the fourth abdominal segment, sparsely haired, light fuscous yellowish; 19 segments, the fifth subsessile, with a length fully twice its diameter; terminal segment greatly produced, tapering, narrowly rounded. Palpi; one stout, narrowly oval segment tapering irregularly; face fuscous yellow. Mesonotum reddish brown, the submedian lines rather thickly clothed with fuscous hairs. Scutellum dark reddish brown, postscutellum dark carmine. Abdomen rather thickly clothed with fine hairs, dark brown, the incisures and pleurae dark carmine. Wings hyaline, costa dark brown; halteres yellowish basally, fuscous apically. Coxae and base of femora pale reddish orange, the remainder of the legs a very dark brown, the tarsi nearly black; claws long, stout, strongly curved, the pulvilli longer than the

claws. Ovipositor about two-thirds the length of the abdomen, the terminal lobes very long, slender, narrowly rounded. Type Cecid. a1647.

Rhopalomyia asteriflorae Felt

1907 **Felt, E. P.** New Species of Cecidomyiidae II, p. 17–18
1908 ——— N. Y. State Mus. Bul. 124, p. 298, 366

This species was reared at Albany, N. Y., from stunted, abnormally bunched heads of Aster paniculata. Two females were obtained September 25, 1907 and despite careful examination of the material in the breeding jar, nothing was found to indicate the part from which the insects emerged. Torymus species was reared apparently from this gall.

Female. Length 2.5 mm. Antennae extending to the third abdominal segment, sparsely haired, pale fuscous yellowish; 19 segments, the fifth subsessile, with a length about two and one-half times its diameter; terminal segment partly fused with the preceding, greatly prolonged, tapering, obtuse. Palpi; one long, irregularly fusiform segment with a length about twice its diameter. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum dark brown with numerous coarse setae apically, postscutellum fuscous orange. Abdomen reddish brown, the incisures and pleurae dark orange, ventral sclerites dark brown. Ovipositor fuscous yellowish. Wings hyaline, costa dark brown; halteres pale yellowish basally, fuscous apically. Coxae and base of femora fuscous yellowish, the distal portion of femora, tibiae and tarsi fuscous; claws rather long, slender, strongly curved, the pulvilli as long as the claws, the ovipositor probably as long as the body, the terminal lobes long, broad, narrowly rounded. Type Cecid. a1757.

Rhopalomyia bigelovioides Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 366, 367

This species was reared by D. W. Coquillett in February from galls on Bigelowia taken at Los Angeles, Cal.

Gall. The gall on the pin bearing one of the specimens is nearly 1 cm long, .4 cm in diameter, irregularly oval and evidently a deformed seed.

Male. Length 2.5 mm. Antennae extending to the third abdominal segment, sparsely haired, light brown; 17 segments, the fifth with a stem one-third the length of the basal enlargement, which latter has a length one-half greater than its diameter and tapers slightly at both extremities; terminal segment prolonged, with a length nearly four times its diameter, tapering, obtuse. Palpi; one stout segment with a length over four times its diameter, tapering, acute. Genitalia; basal and terminal clasp segments long, stout; ventral plate long, narrow, deeply and triangularly emarginate; harpes broad, convolute, irregularly rounded. Color and other characters nearly as in the female.

Female. Length 2.5 mm. Antennae probably extending to the third abdominal segment, sparsely haired, yellowish brown; 18 seg-

a b

Fig. 77 Rhopalomyia bigelovioides; fifth antennal segment and palpus, (a) of female (b) of male, enlarged (original)

ments, the fifth with a length two and one-half times its diameter, tapering at each extremity; terminal segment reduced, broadly oval. Mesonotum shining dark brown, submedian lines sparsely haired. Scutellum reddish brown, postscutellum a little lighter. Abdomen sparsely haired, light brown, the terminal segment somewhat darker, venter a little lighter. Wings hyaline, costa light brown; halteres yellowish brown basally, yellowish white apically. Legs a nearly uniform light brown; claws long, stout, evenly curved, the pulvilli one-ha f longer than the claws. Ovipositor about two-thirds the length of the abdomen, the terminal lobes long, narrowly oval. Type Cecid. 940.

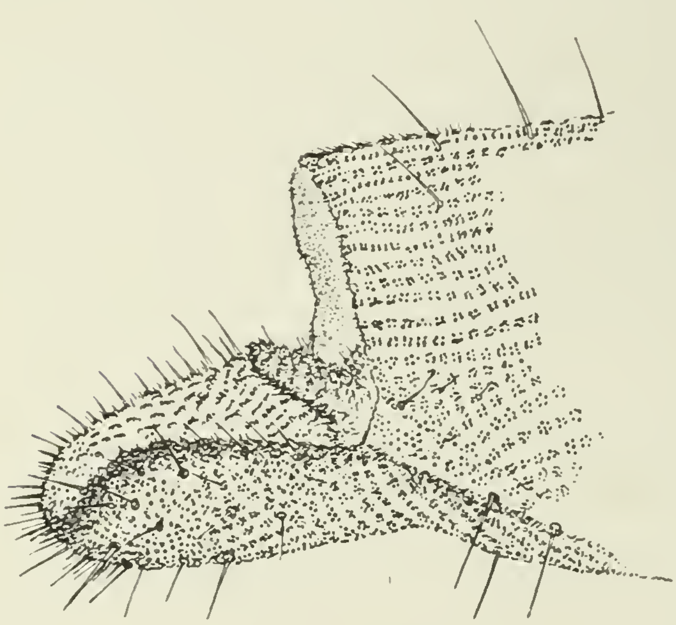


Fig. 78 Rhopalomyia bigelovioides; tip of ovipositor, lateral view, enlarged (original)

Rhopalomyia pilosa Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 366, 367

This species was reared by Mr T. N. Willing of Medicine Head, North West Territory, from a large, densely woolly apical gall, presumably on Antennaria.

Gall. The galls are white, woolly aggregations with nearly snow-white fibers about 5 mm long, radiating from rather hard, thin-shelled cavities inhabited by the larvae.

Male. Length 2 mm. Antennae probably as long as the body, sparsely haired, brown, the stems yellowish transparent; presumably 17 segments, the fifth with a stem as long as the basal enlargement, which latter has a length nearly twice its diameter. Palpi; one long, somewhat fusiform segment, tapering, acute. Mesonotum fuscous yellowish, the submedian lines lighter, sparsely haired. Scutellum fuscous yellowish, postscutellum a little lighter. Abdomen fuscous yellowish, somewhat darker at the extremities. Wings hyaline, costa light brown; halteres yellowish transparent. Legs variably fuscous yellowish; claws long, slender, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment short, stout, greatly swollen near the middle; dorsal plate long, broad, deeply and triangularly emarginate; ventral plate short, broad, broadly and rather roundly emarginate. Harpes long, stout, tapering, irregularly rounded, tuberculate.

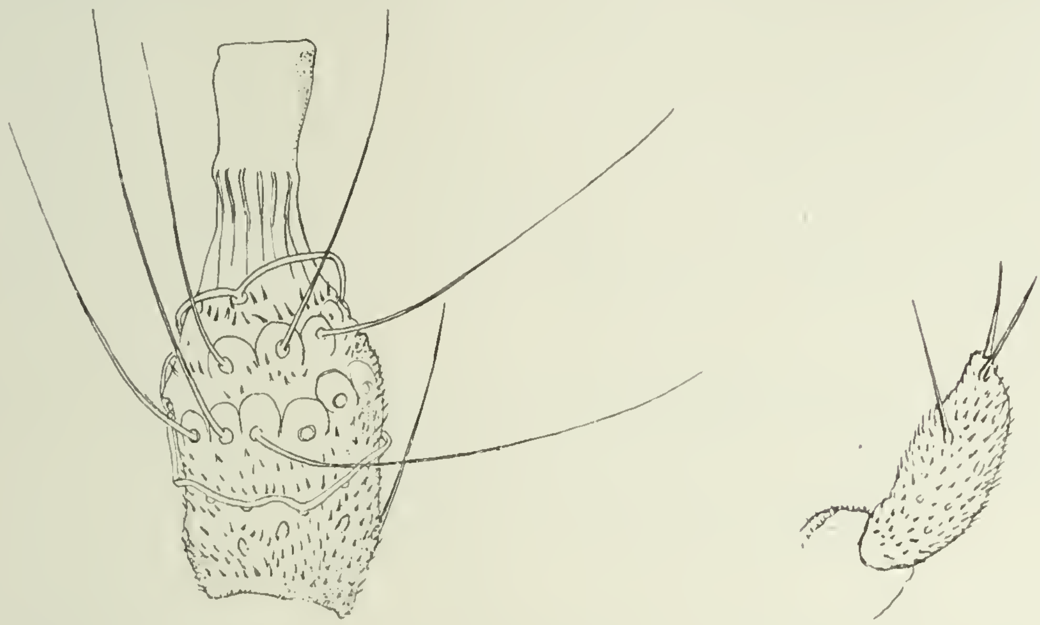


Fig. 79 Rhopalomyia pilosa; fifth antennal segment of male and palpus, enlarged (original)

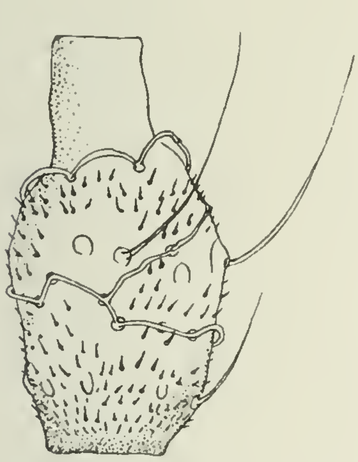


Fig. 80 Rhopalomyia pilosa; fifth antennal segment of female, enlarged (original)

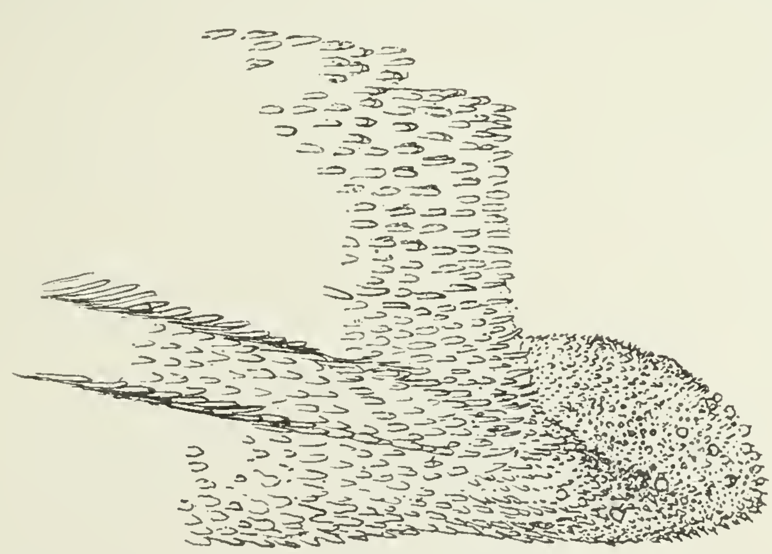


Fig. 81 Rhopalomyia pilosa; lateral view of the tip of the ovipositor, enlarged (original)

Female. Length 2 mm. Antennae probably nearly as long as the body, sparsely haired, fuscous yellowish; 17 segments, the fifth with a stem one-fourth the length of the basal enlargement, which latter has a length nearly twice its diameter; terminal segment produced, narrowly oval. Mesonotum dark brown, the submedian lines sparsely clothed with fine hairs. Scutellum yellowish transparent, postscutellum brown. Abdomen a variable fuscous yellowish, darker at the extremities. Wings hyaline, costa light brown. Ovipositor stout, nearly as long as the abdomen, the terminal lobes short, stout, tapering, narrowly rounded. Type Cecid. 1215.

Rhopalomyia cruziana Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 366, 367
1909 ———— Ottawa Nat., 22:246

The galls of this species occur on the flowers of Solidago and were collected in the Santa Cruz mountains, California, during August, 1889, the adults issuing before May 1890.

Male. Length 1.5 mm. Antennae nearly as long as the body, sparsely haired, light brown; 17 segments, the fifth with a stem as long as the basal enlargement, which latter has a length one-half greater than its diameter; terminal segment greatly produced, tapering, narrowly rounded. Palpi; the first segment very broad, irregularly subglobular, the second slender, with a length about twice its diameter, obtusely rounded. Mesonotum shining brown, the submedian lines indistinct. Scutellum yellowish brown, postscutellum a little lighter. Abdomen sparsely clothed with fine hairs, light brown. Wings hyaline, costa light brown. Halteres pale yellowish, yellowish white distally. Legs a variable yellowish straw, the distal tarsal segments light brownish; claws long, slender, evenly curved, the pulvilli longer than the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment short, stout; dorsal plate long, broad, deeply and triangularly emarginate; ventral plate long, broad, broadly emarginate. Harpes long, convolute, irregularly rounded.

Female. Length 2.25 mm. Antennae extending to the third abdominal segment, sparsely haired, light yellowish brown; 15 seg-

Fig. 82 Rhopalomyia cruziana; fifth antennal segment, palpus and claw of female, enlarged (original)

ments, the fifth with a length three-fourths greater than its diameter, narrowly rounded at the extremities; terminal segment produced, tapering, obtusely rounded. Palpi; the first segment short, stout, swollen distally, the second hardly longer than the first, more slender, tapering, narrowly rounded. Ovipositor about as long as the body,

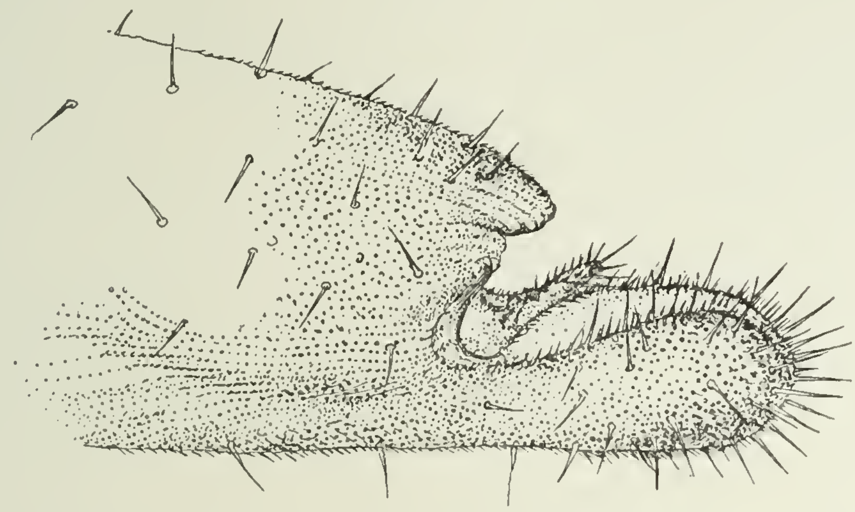


Fig. 83 Rhopalomyia cruziana; tip of ovipositor, enlarged (original)

the terminal lobes long, narrowly oval. Other characters practically as in the opposite sex. Type Cecid. 942.

Rhopalomyia lanceolata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 367, 368
1909 ———— Ottawa Nat., 22: 247

This species was reared by Dr James G. Needham from what he designates as a spongy gall on the narrow-leaved golden-rod, Solidago graminifolia, presumably from Lake Forest, Ill.

Gall. The gall closely resembles that made by Asphondylia monacha O. S. and it may be that this species is an inquiline.

Male. Length 2.5 mm. Antennae nearly as long as the body, sparsely haired, light yellowish; 17 segments, the fifth with a stem three-fourths the length of the basal enlargement, which latter has a length twice its diameter; terminal segment reduced, narrowly oval, subacute distally. Palpi; one long, stout segment having a length twice its diameter. Mesonotum light brown, the submedian lines broad, yellowish, the posterior median area and scutellum yellowish, postscutellum dark brown. Abdomen light yellowish, lighter than in the female. Wings hyaline, costa light brown; halteres pale yellowish. Legs whitish transparent; claws long, slender, evenly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment short, stout, swollen near the middle; dorsal plate very short, broad, broadly and triangularly emarginate; ventral plate long, broad, tapering, slightly emarginate. Harpes large, broad, convolute, narrowly rounded.

Female. Length 3 mm. Antennae extending to the third abdominal segment, sparsely haired, pale yellowish; 15 segments, subsessile, the fifth with a length two and one-half times its diameter,

tapering; terminal segment slightly reduced, tapering, narrowly rounded. Ovipositor probably as long as the abdomen, the terminal lobes slender, with a length twice the diameter, narrowly rounded. Otherwise nearly as in the male. Type Cecid. 784.

Rhopalomyia antennariae Whlr.

1891 **Riley, C. V. & Howard, L. O.** Ins. Life, 4: 125 (Synopeas antennariae Ashm. reared, Cecidomyia)

1899 **Wheeler, W. M.** Wis. Nat. Hist. Soc. Proc., p. 209-12 (Cecidomyia)

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 367

This species was first reared by Dr W. M. Wheeler in the spring of 1888 and 1889 and referred to the genus Cecidomyia. The gall, he states, is produced from a puncture of the terminal bud of the plantlet early in April, the insects probably appearing soon after the snow melts. Pupation takes place the first week in May, the change from the larva to the pupa being very gradual. The adults appear about the middle of May and are not very active. A number of galls were sent by Doctor Wheeler to the Bureau of Entomology, Washington, D. C., and adults bred therefrom the last of May, together with several parasites, the occurrence of Platygaster and a Pteromalid being recorded. The detailed descriptions of adults given below are based on material reared at Washington. Doctor Wheeler states that one female kept in confinement deposited her orange-colored ova in the leaf axil of a healthy green shoot of a plant, most of the terminal buds of which had been previously converted into galls. Doctor Wheeler states that an insect may deposit from one to fifteen eggs in each bud, an average of three to seven and that numerous larvae are found imbedded in the woolly center of the gall and, though near each other, usually isolated by filaments of matted hairs. This species and the associated Asphondylia antennariae were so abundant as to seriously affect a large proportion of the host plants, Antennaria plantaginifolia.

Gall. The gall, according to Doctor Wheeler, is from about 3 to 5 mm in diameter, corm-shaped and is produced by a check in the growth of the scapelike flower-bearing stem, the sessile leaves of which become somewhat succulent, broader and longer than under normal circumstances, and excepting the tips, which are somewhat recurved, are closely applied to one another like the leaves of an onion. Both surfaces of the component leaves of the gall are covered with woolly hairs, while the parenchyma is more or less discolored with reddish. Frequently all of the terminal buds of a plant are transformed into galls by this insect.

Male. Length 2 to 3 mm. Antennae about as long as the body, thickly haired, light brown; 16 segments, the fifth with a stem about equal the length of the basal enlargement, which latter has a length

about twice its diameter, tapers slightly basally; terminal segment produced, narrowly oval. Palpi; the first segment short, stout, irregularly oval, the second long, slender, tapering; face fuscous yellowish. Mesonotum dark brown. Scutellum and postscutellum reddish brown. Abdomen dark reddish brown. Wings hyaline, costa light brown. Halteres pale yellowish. Legs a variable fuscous yellowish; claws long, slender, evenly curved, the pulvilli longer than the claws. Genitalia; basal and terminal clasp segments long, stout; the latter swollen near the basal third; dorsal plate short, broad, broadly and triangularly incised; ventral plate short, broad, broadly and roundly emarginate.

Female. Length 2.5 mm. Antennae extending to the fourth abdominal segment, sparsely haired, pale yellowish; 16 segments, the fifth subsessile, with a length about twice its diameter; terminal

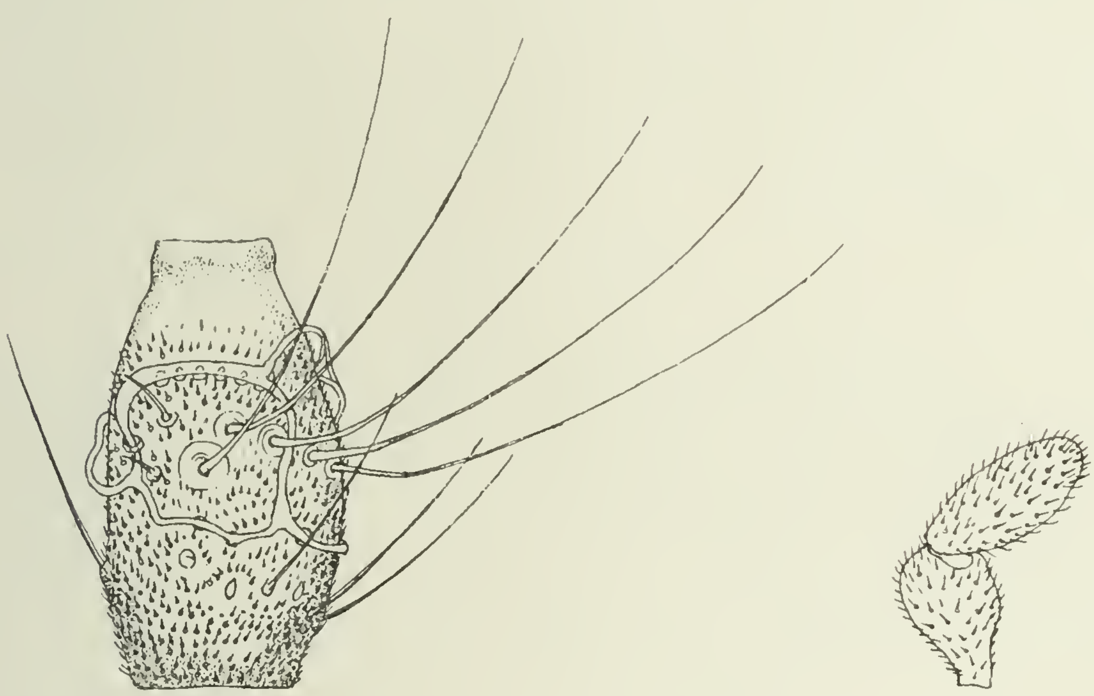


Fig. 84 Rhopalomyia antennariae; fifth antennal segment and palpus of female, enlarged (original)

segment produced, narrowly rounded apically. Mesonotum dark brown, the sublateral and posterior median areas reddish brown. Scutellum and postscutellum dark brown. Abdomen light brown (in life bright orange red), the basal segment of the ovipositor dark brown, the apical one pale salmon. Ovipositor about as long as the abdomen, the terminal lobes stout, somewhat contracted basally, narrowly rounded, otherwise practically as in the opposite sex. Type Cecid. 960.

Rhopalomyia tridentatae Rubs.

1893 **Rubsaamen, E. H.** Ent. Nachrichten, 19: 163

This species, according to Rubsaamen, produces a gall on Artemisia tridentata, much resembling that made by the

European Rhopalomyia artemisiae Bouché on Artemisia campestris, namely an oval bud enlargement. Doctor Rubsaamen states that he received galls and flies from Herr Doctor Von Schlechtendal of Halle. There is a gall in the Museum of Comparative Zoology from California which may be referable to this species.

Rhopalomyia grossulariae Felt

1911 **Felt, E. P.** Econ. Ent. Jour., 4: 347

This was reared from deformed gooseberry buds in May 1911 by J. S. Houser of the Ohio Agricultural Experiment Station. The material was collected at Camp Chase. It approaches in antennal characters the North American Rhopalomyia tridentatae Rubs. reared from Artemisia, though it is easily distinguished by the uniarticulate palpi.

Rhopalomyia alticola Ckll.

1890 **Cockerell, T. D. A.** Ent., p. 281 (Cecidomyia)
1895 **Baker, C. F.** Ent. News, 6: 173
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 367

This species produces a globular woolly gall on the branches of Artemisia in Colorado. The following descriptions of the adult and gall have been drafted from material kindly put at our disposal by Prof. T. D. A. Cockerell December 17, 1906, the imagoes appearing the middle of the following January.

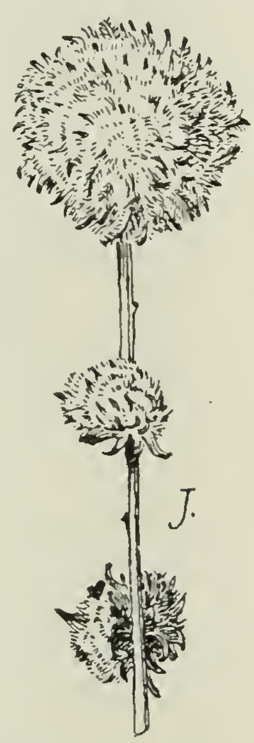


Fig. 85 Rhopalomyia alticola; gall nearly natural size (original)

Gall. The gall is subglobular, grayish, woolly, ranging in diameter from .7 to 1.5 cm. Each is composed of a number of hard, thin walled, narrowly oval cells thickly covered with cottony matter and surrounded with small bracts, the latter also thickly clothed with white down.

Male. Length 2.5 mm. Antennae extending to the third abdominal segment, sparsely haired, reddish brown, 16 or 17 segments; the fifth with a stem one-third the length of the vasiform enlargement. Palpi uniarticulate, the segment long, slender. Face fuscous brown, mesonotum dark brown, submedian lines fuscous, apparently slightly elevated, sparsely clothed with fine hairs. Pleurae mostly light reddish, scutellum and postscutellum dark brown,

the former with a few sparse setae apically. Abdomen sparsely clothed with pale yellowish hairs, a light yellowish brown, the basal

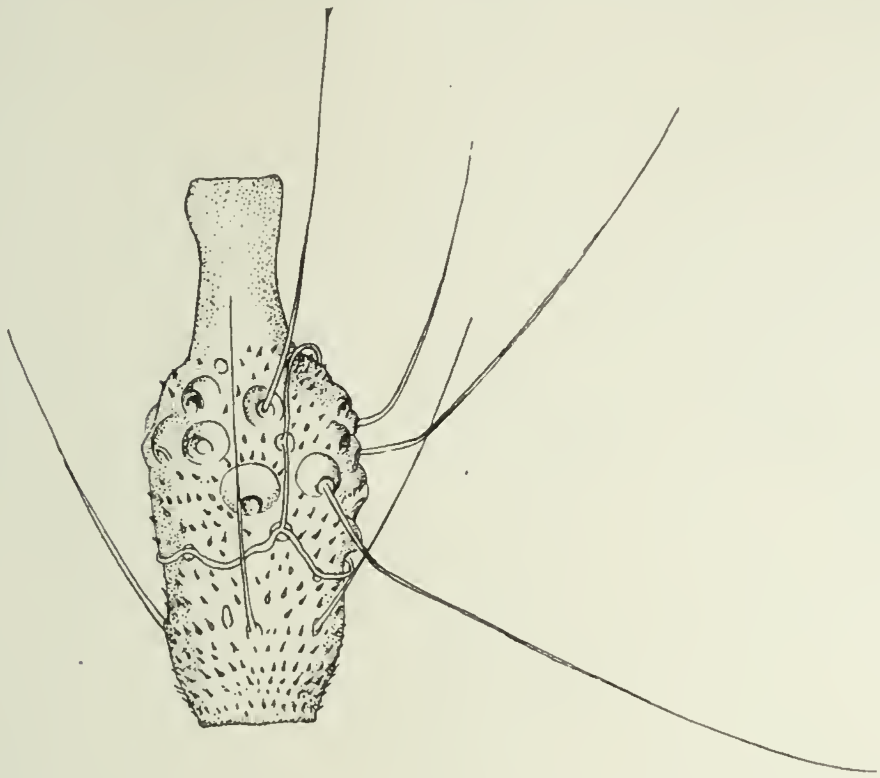


Fig. 86 Rhopalomyia alticola; fifth antennal segment of male, enlarged (original)

segment very dark brown, the genitalia reddish brown. Wings hyaline, costa dark brown; halteres yellowish basally, fuscous apically, the distal portion of the stem reddish brown. Legs a nearly uniform fuscous reddish brown, the coxae and distal tarsal segments darker; c'aws long, stout, evenly curved. Genitalia; basal clasp segment long, stout; terminal clasp segment very short, stout; dorsal plate short, broad, deeply and narrowly incised; ventral plate broad, broadly and triangularly incised.

Female. Length 2.5 mm. Antennae extending to the fourth abdominal segment, sparsely haired, dark red, 16 segments; the fifth with a stem one-fourth the length of the basal enlargement; terminal segment slightly prolonged, obtuse. Palpi uniarticulate, the segment long, stout. Mesonotum brownish black, submedian lines sparsely ornamented with yellowish hairs. Scutellum brownish black, postscutellum dark brown; pleurae reddish with fuscous markings especially on the margins of the sclerites. Abdomen reddish brown, very sparsely clothed with fine hairs, dark reddish ventrally. Ovipositor fuscous yellowish. Legs, a variable fuscous yellow, tarsi slightly darker, the tips of the coxae darker; claws rather long, stout, evenly curved. Ovipositor probably about two-thirds the length of the body, the terminal lobe long, broad, obtuse. Type Cecid. 768.

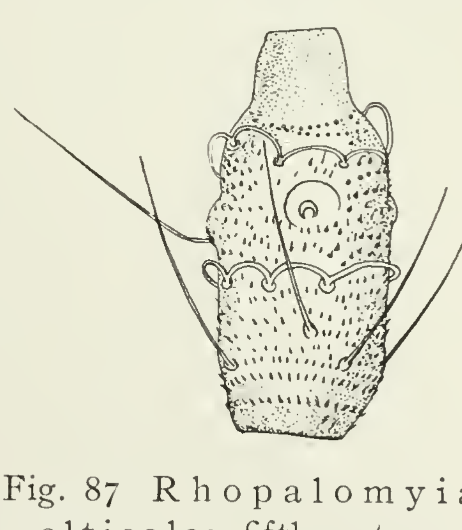


Fig. 87 Rhopalomyia alticola; fifth antennal segment of female, enlarged (original)

Rhopalomyia arcuata Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 158–59
1908 ———— N. Y. State Mus. Bul. 124, p. 367

This species was taken at Albany, N. Y., June 4, 1906 while sweeping Solidago and sweet fern.

Male. Length 2 mm. Antennae probably as long as the body, sparsely haired, pale straw; at least 15 segments, the fifth with a stem one-fourth longer than the slightly fusiform basal enlargement. Palpi composed of one rather long, fusiform segment, acute distally. Face dark brown, sparsely clothed with fuscous hairs. Scutellum yellowish brown, sparsely setose apically; postscutellum orange brown. Abdomen thickly clothed with fuscous hairs, dark brown. Wings hyaline, costa light brown. Halteres yellowish transparent basally, fuscous apically. Coxae fuscous yellowish. Legs pale straw, the claws stout, slightly curved. Genitalia; basal clasp segment stout; terminal clasp segment short, stout; dorsal plate short, broad, slightly emarginate. Harpes short, irregular, much convoluted, the curved ventral and posterior margins strongly chitinized. Type Cecid. 124.

Rhopalomyia gutierreziae Ckll.

1901 **Cockerell, T. D. A.** Can. Ent., 33: 23 (Asphondylia)
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 367, 368

This species produces a pale green, fusiform or suboval swelling in the flower heads of Gutierrezia sarothrae. The gall is about 7 mm long, 3 mm broad and was taken at Las Vegas, N. M., adults appearing October 31st. An examination of the types in the United States National Museum shows that it probably belongs to this genus. Professor Cockerell, writing September 9, 1907, transmits what he considers as probably the same insect taken by Mr Frank Springer on the same plant, the adults appearing at the time of writing and emerging from apparently unmodified florets. Professor Cockerell states that the female he described had 17 antennal segments, while the one transmitted had about 13 or 14 segments. It may be that there are two entirely different insects, in which event this form must be a new species. The following descriptions have been drafted from these specimens, except that certain color characteristics have been taken from Professor Cockerell's original description.

Male. Length 1.5 mm. Antennae extending to the fourth abdominal segment, sparsely haired, pale brown; 15 segments, the fifth with a stem two-thirds the length of the basal enlargement, which latter has a length one-half greater than its diameter and is roundly tapering at both extremities; terminal segment produced,

narrowly oval. Palpi; a single irregular slender segment with a length about four times its diameter. Mesonotum shining fuscous,

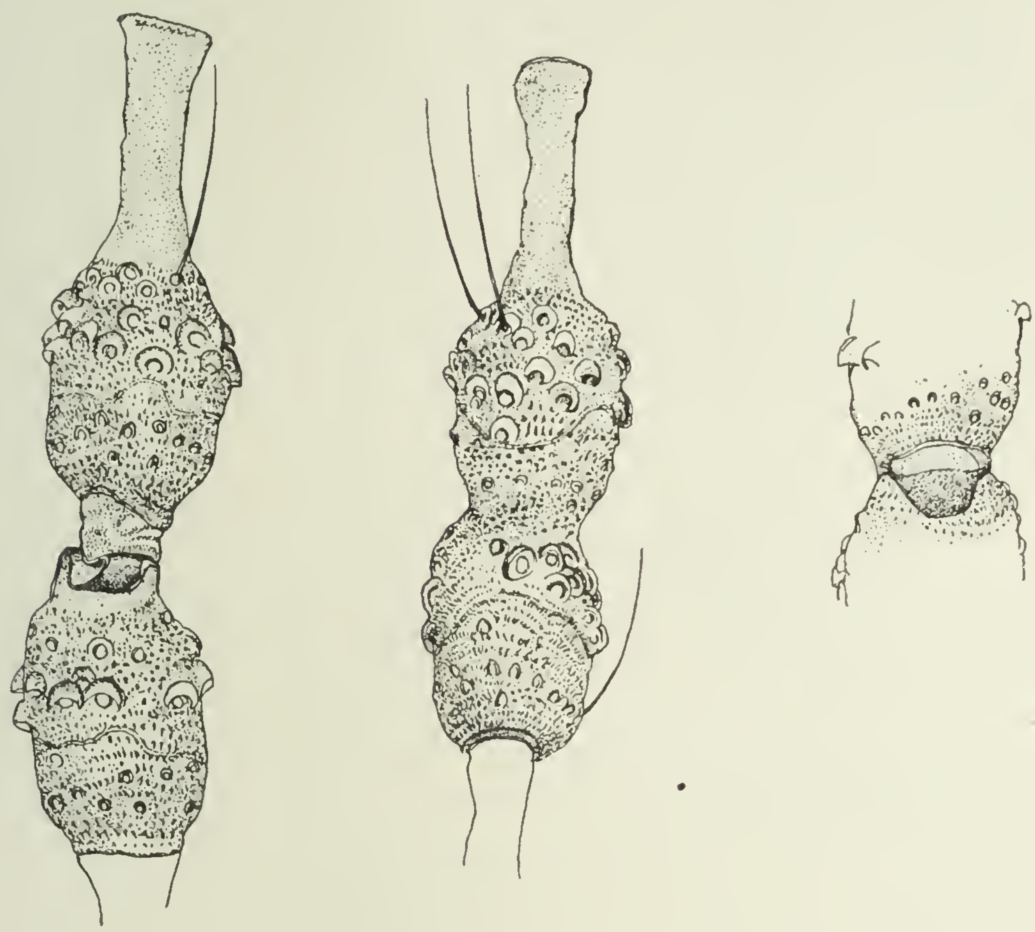


Fig. 88 Rhopalomyia arcuata; antennal deformations showing various stages, enlarged (original)

the submedian lines indistinct. Abdomen brown. Wings hyaline, costa pale brown. Halteres yellowish. Femora pale brown, tibiae and tarsi darker; claws long, slender, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment short, stout, swollen near the middle; dorsal plate long, broad, apparently divided, the lobes irregularly oval, with an obtuse angular projection; ventral plate apparently long, broad, broadly rounded.

Female. Length 2 mm. Antennae extending to the third abdominal segment, sparsely haired, pale brown; 13 to 14 segments, the fifth subsessile, with a length one-half greater than its diameter, somewhat rounded at the extremities; the two terminal segments sometimes fused, the fourteenth prolonged, nearly twice the length of the preceding. Palpi; one stout segment with a length nearly three times its diameter. Mesonotum reddish brown, shining, naked, the submedian and sublateral lines sparsely ornamented with pale hairs. Abdomen nearly naked, bright red (the base frequently fuscous, becoming reddish distally), the ovipositor whitish yellowish. Pulvilli longer than the claws. Ovipositor about one-half the length of the abdomen, stout, the terminal lobes long, slightly contracted at the base, narrowly rounded. Type Cecid. a1742.

Rhopalomyia bigeloviae Ckll.

1889 **Cockerell, T. D. A.** Ent. Month. Mag., 25: 324, 363 (Cecidomyia)
1890 ———— Ent. Month. Mag., 26: 109 (Cecidomyia, p. 324; note)
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 368

The gall produced by this species was first observed by Professor Cockerell in Colorado during 1889, adults being obtained the latter part of that year and described in 1900. This species was reared from a hollow gall on Bigelovia, apparently nothing but females being obtained. It is possible that further study may show R. bigelovioides to be but a larger form of this species. For the present it seems advisable to make a distinction between the two. The following characterization of this species is drafted from a specimen received from the United States National Museum and labeled Cecidomyia bigeloviae. It is undoubtedly a cotype. It also bore the following labels: "from gall on Bigelovia, May 1889. T. D. A. Cockerell, Custer co., Col." A species of Trypeta described by Professor Cockerell as T. bigeloviae has also been reared from this deformity together with examples of Anthonomus canus Lec., a species of Torymus and Eurytoma bigeloviae Ashm.

The egg of this species has been described by Professor Cockerell, as elongate, with rounded ends, approximately parallel sides and orange contents.

Female. Length 2.5 mm. Antennae extending to the third abdominal segment, sparsely haired, pale yellowish or brownish;

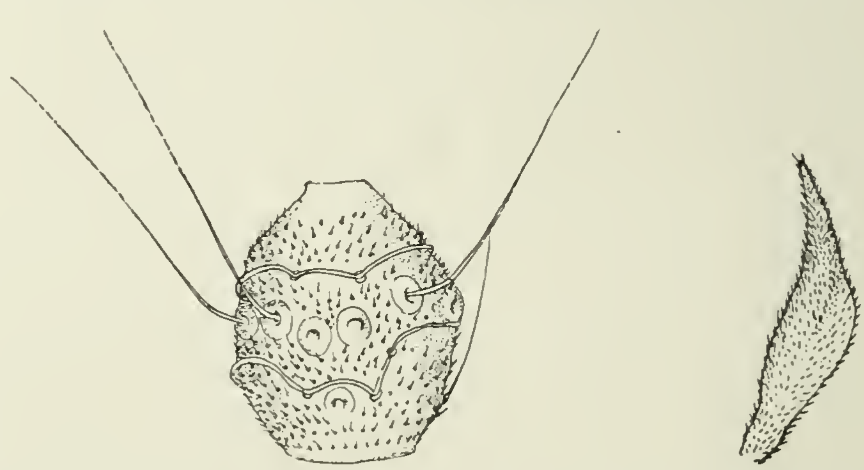


Fig. 89 Rhopalomyia bigeloviae; fifth antennal segment and palpus of female, enlarged (original)

15 sessile segments, the fifth with a length one-half greater than its diameter, somewhat rounded at both extremities; terminal segment produced, with a length over three times its diameter. Palpi; one slender, fusiform segment, having a length fully four times its diameter and constricted at the point of insertion, distally tapering, acute. Mesonotum light reddish brown. Scutellum a little darker,

postscutellum reddish brown. Abdomen light yellowish brown (dull pinkish red in life); ovipositor pale yellowish. Wings hyaline, costa light brown. Halteres pale yellowish or whitish, legs mostly yellowish brown; claws long, slender, evenly curved, the pulvilli as long as the claws. Ovipositor about two-thirds the length of the abdomen, the terminal lobes short, stout, narrowly rounded. Type Cecid. 1070.

Rhopalomyia audibertiae Felt

1907 **Felt, E. P.** New Species of Cecidomyidae II, p. 18
1908 ———— N. Y. State Mus. Bul. 124, p. 299, 368

This species was reared from a gall on Audibertia stachyoides in April.

Male. Length 1.5 mm. Antennae probably nearly as long as the body, sparsely haired, light brown; 14 segments, the fifth with a stem three-fourths the length of the basal enlargement, which latter

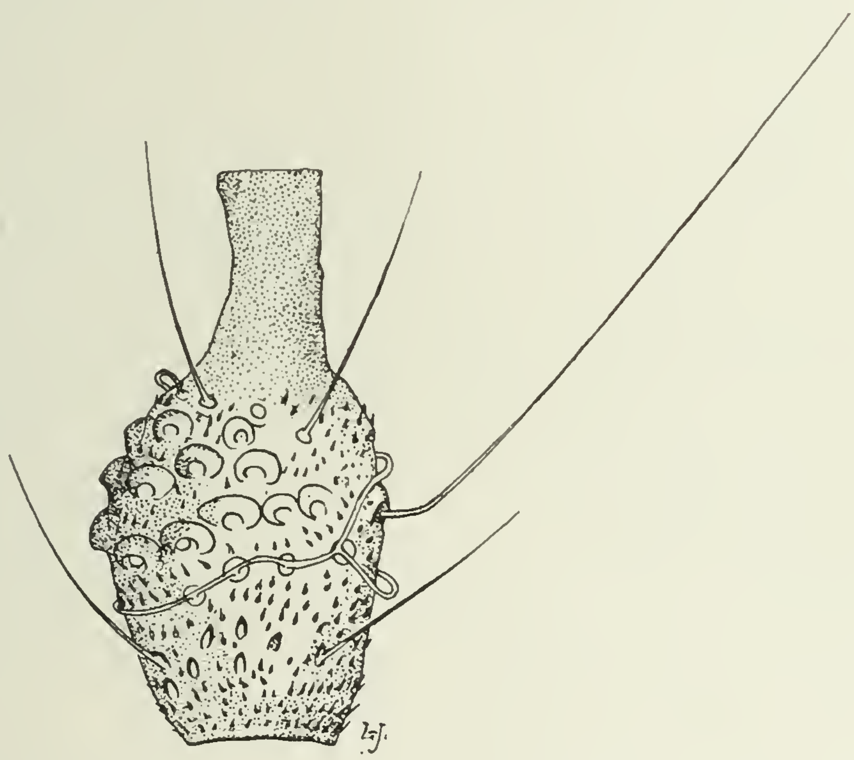


Fig. 90 Rhopalomyia audibertiae; fifth antennal segment of male, enlarged (original)

has a length one-half greater than its diameter; terminal segment produced, obtuse. Palpi consisting of one short, stout, irregular segment. Mesonotum dark reddish brown. Scutellum reddish brown. Abdomen dark brown. Wings hyaline, costa light straw. Legs light straw; claws long, stout, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment short, greatly swollen basally; dorsal plate short, broad, apparently divided; ventral plate short, broad, broadly and roundly emarginate. Harpes short, stout, obliquely truncate and with large, irregular teeth apically.

Female. Length 2 mm. Antennae extending to the base of the abdomen, sparsely haired, light brown; 12 segments, the fifth sessile.

tapering at both extremities and with a length one-half greater than its diameter; terminal segment produced, tapering, narrowly rounded. Palpi; consisting of one short, subglobose segment. Mesonotum dark reddish brown. Scutellum reddish brown. Abdomen dark brown. Halteres yellowish transparent. Legs light straw; claws long, slender, strongly curved, the pulvilli as long as the claws. Ovipositor about two-thirds the length of the body, the terminal lobes short, stout, tapering, narrowly rounded. Type Cecid. 1029.

Rhopalomyia castaneae Felt

1909 **Felt, E. P.** Econ. Ent. Jour., 2: 291

A fuscous orange female was reared June 13, 1908 from the leaf petiole of chestnut, Castanea dentata, taken at Stowe, Mass.

Gall. The injury is primarily to the leaf petiole though the affected area may embrace the entire tip of the twig and cause a deformity similar to brussels sprouts.

Female. Length 1.75 mm. Antennae hardly extending to the base of the abdomen, sparsely haired, dark brown, the basal segments yellowish; 12 segments, the fifth with a length one-fourth greater than its diameter, tapering distally; terminal segment slightly produced, tapering to a narrowly rounded apex. Palpi biarticulate; face yellowish. Mesonotum dark brown, the broad submedian lines yellowish, sparsely haired. Scutellum reddish orange, postscutellum reddish brown. Abdomen a deep fuscous orange, sparsely haired, the ovipositor yellowish. Wings almost subhyaline, thickly haired, costa dark brown. Halteres pale orange. Legs mostly dark brown; claws long, slender, evenly curved, the pulvilli distinctly longer than the claws. Ovipositor nearly as long as the abdomen, the terminal lobes long, slender, with a length about five times their diameter. Type Cecid. a1716.

Rhopalomyia chrysopsidis Lw.

1862 **Loew, Hermann.** Mon. Dipt. N. Amer., 1: 203–4 (Cecidomyia)
1893 **Townsend, C. H. T.** Ent. Soc. Wash. Proc., 2: 389 (Cecidomyia)

The gall produced by this species on Chrysopsis mariana is apical, light brown, irregular, woolly and about three-fourths of an inch in diameter. The interior consists of many single galls which have no compartments and coalesce here and there, each being conical unless modified by pressure. The gall described by Townsend as cited above, appears to be quite different and, judging from the account, may have produced a species of Lasioptera. We have provisionally referred the form described by Loew to Rhopalomyia.

Sackenomyia Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 361
1910 **Rubsaamen, E. H.** Zeitsch. Wissenschaft. Insektenbiol., 15: 337
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19: 47
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 48

This genus is allied to Rhopalomyia from which it is easily separated by the heavily chitinized cultriform distal portion of the ovipositor and the bi- or triarticulate palpi. The antennal segments may vary in number from 12 to 22, being subsessile in the female and with a short stem in the male. The male genitalia of S. packardi are unusually large; the dorsal plate is unique, being broadly rounded and but slightly emarginate, while the ventral plate is long, narrow, deeply and narrowly emarginate, the lobes being long and slender. The type of this genus is Oligotrophus acerifolius Felt.

Key to species

a Length 1.5 mm; abdomen light yellowish
  b 12 subsessile antennal segments, wings rather narrow
    acerifolia Felt, C. 38
  bb 13–14 antennal segments, fifth of male with a stem as long as the basal enlargement, wings rather broad; reared from swollen, purplish leaf veins on Viburnum dentatum............. viburnifolia Felt, C. a1896
aa Length 2 mm; abdomen yellowish brown; probably 18–22 antennal segments
    porterae Ckll., C. 1252
aaa Length, female, 3.5 mm, abdomen dark red, 21 antennal segments; male, length 2.75 mm, antennal segments 22...... packardi Felt, C. a1934

Sackenomyia acerifolia Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 121 (separate, p. 27) (Oligotrophus)
1908 ———— N. Y. State Mus. Bul. 124, p. 361

This small species was taken at Albany, N. Y., May 17, 1906 while sweeping maple and other bushes.

Female. Length 1.5 mm. Antennae not extending to the base of the abdomen, sparsely haired, light brown; 12 segments, the fifth subsessile, subcylindric, slightly rounded in the middle; terminal segment subconic, broadly rounded. Palpi; the first segment slender, with a length nearly four times its diameter, the second subquadrate, with a length one-half greater than its diameter, the third more than twice the length of the second, tapering, acute. Face yellowish. Mesonotum yellowish brown. Abdomen light

yellowish, slightly fuscous apically. Wings hyaline, rather narrow, costa pale straw. Halteres yellowish transparent. Legs, coxae,

Fig. 91 Sackenomyia acerifolia; fifth antennal segment and palp, much enlarged (author's illustration)

femora and tibiae yellowish transparent; tarsi dark brown, the anterior with the basal articulations yellow banded, the posterior

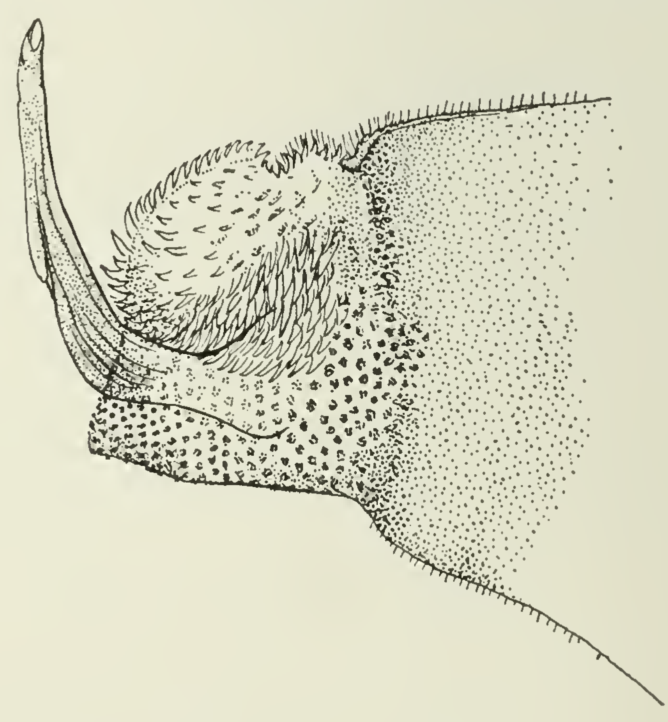


Fig. 92 Sackenomyia acerifolia; lateral view of ovipositor, much enlarged (author's illustration)

with the basal tarsal segments yellow; claws stout, simple. Ovipositor short, the distal part cultriform and with a length equal to the diameter of the last abdominal segment. Type Cecid. 38.

Sackenomyia viburnifolia Felt

1909 **Felt, E. P.** Econ. Ent. Jour., 2:290

This small, yellowish species was reared in numbers the latter part of April 1909 from purplish vein swellings on arrowwood, Viburnum dentatum, collected at Magnolia, Mass., in the

fall of 1908 by Miss Cora H. Clarke and also found at the same time locally abundant in the vicinity of both Albany and Nassau, N. Y.

Gall. The gall, a purplish swelling on both sides of the lateral veins of the leaf, is some 5 mm long, 3 mm in diameter and tapering at both extremities (Plate 16 figure 2). Two galls may occur on one vein and as many as 8 or 10 on a leaf. The larva lies just beneath the vein.

Larva. Length 1.75 mm, whitish, stout, the extremities broadly rounded. Head small; antennae short, stout; breastbone broadly bidentate, disappearing posteriorly. Skin nearly smooth; posterior extremity broadly rounded.

Exuviae. Length 1 mm, whitish transparent. Antennal cases stout, tapering to an acute apex, scarcely thickened at the internal basal angle; thoracic horns long, stout, curved. Wing cases extending to the third abdominal segment, leg cases to the fourth and fifth abdominal segments, the latter thickly dotted dorsally with fine, chitinous points.

Male. Length 1 mm. Antennae as long as the body, thickly haired, dark brown, the stems white; 14 segments, the fifth with a stem as long as the cylindric basal enlargement, which latter has a length one-half greater than its diameter; terminal segment reduced, tapering, narrowly rounded. Palpi; the first segment short, stout, the second broadly oval, the third slender, with a length six times its width. Mesonotum and body a nearly uniform pale orange. Wings hyaline, rather broad, costa dark brown. Halteres pale orange, fuscous apically. Coxae and femora basally, pale orange, the distal portion of femora, tibiae and tarsi mostly dark brown; claws slender, strongly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, slender; terminal clasp segment rather short, stout at base; dorsal plate broad, deeply and triangularly incised; ventral plate long, broad, subtruncate, slightly emarginate.

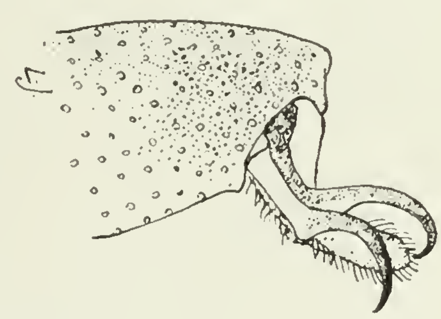


Fig. 93 Sackenomyia viburnifolia; lateral view of claw and tip of last tarsal segment of male, enlarged (original)

Female. Length 1.5 mm. Antennae extending to the third abdominal segment, rather thickly haired, pale orange, slightly fuscous apically; 13 or 14 segments, the fifth with a length one-half greater than its diameter; terminal segment with a length four times its diameter when there are but 13, or reduced when there are 14 segments. Ovipositor about one-fourth the length of the body, the basal part stout, swollen, the terminal portion chitinized, irregularly cultriform. Type Cecid. a1896.

Sackenomyia porterae Ckll.

1904 **Cockerell, T. D. A.** Can. Ent., 36: 155–56 (Rhabdophaga)

This species, according to Prof. T. D. A. Cockerell of Boulder, Col., produces a slight, irregular, smooth swelling on a very small

twig of red willow, Salix species. The gall may be only about 2 mm long with but one cell, or 6 or 7 mm long and containing a half dozen or more larvae. It is inconspicuous in all cases and appears like a small, gouty swelling of the twig. It was taken by Professor Cockerell at Las Vegas, N. M., January 31. The following was drafted from type material kindly placed at our disposal by Professor Cockerell.

Gall. Irregular swellings somewhat like aborted galls of Rhabdophaga batatas Walsh on small twigs about one-eighth of an inch in diameter.

Exuviae. About 1.5 mm long, the cephalic horns long, stout, reddish brown, approximate and tapering to an obtuse apex; antennal sheaths with the basal segment reddish brown, the others yellowish transparent and showing distinctly 18 segmental constrictions. The other portions of the exuviae are semitransparent, the wing cases extending to the third abdominal segment, the leg cases to the fourth; the dorsum of the abdominal segments thickly and uniformly clothed with short, stout spines; terminal segment broadly rounded.

Female. Length 1.5 mm. Antennae probably as long as the body, sparsely clothed with fine hairs; 18–22 segments, the third cylindric, with a length equal to about three times its diameter, slightly swollen near the basal fourth, tapering. Palpi; the first segment short, stout, subglobular, or in some specimens, prolonged, slender, cylindric, the second a little longer, suboval, the third one-half longer than the second, more slender, tapering. Mesonotum reddish brown, the submedian lines inconspicuous. Scutellum dark reddish brown, pale yellowish apically, postscutellum dark brown. Abdomen a deep fuscous yellowish or dark brown, the segments apparently sparsely clothed with fuscous scales posteriorly, the eighth segment enlarged, subglobular. Wings hyaline, costa light brown. Halteres fuscous basally, yellowish white apically. Legs, so far as evident, yellowish transparent; claws simple. The dorsum of the subglobular eighth abdominal segment with an irregular, triangular, chitinous plate. Ovipositor one-half the length of the abdomen, the basal segment stout, tapering; terminal segment cultriform, heavily chitinized. Type Cecid. 1252.

Sackenomyia packardi Felt

1909 **Felt, E. P.** Econ. Ent. Jour., 2: 290–91

Both sexes were reared April 15 and 16, 1909 from irregularly swollen twigs of the long leaved willow, Salix longifolia, collected by Winthrop Packard at Canton, Mass., March 6, 1909 and forwarded by Miss Cora H. Clarke of Boston. The latter found the gall near Boston, Mass., November 9, 1907. The midge flies in early spring, since galls received from Mr Packard May 4th

contained pupae, the adults issuing therefrom May 19th. This species appears to have been reared in February 1890 at the then Division of Entomology, Washington, D. C., from galls received from O. S. Westcott, Maywood, Ill., and apparently the same species was reared by L. H. Weld, April 27, 1908, at Evanston, Ill. Polygnotus and Eurytoma species were reared from shoots infested by the larvae of this midge and those of Rhabdophaga podagrae Felt.

The gall is a slight, irregular swelling occurring on small twigs, with a diameter of only about 2 mm and also on twigs having a diameter of 1 cm. The galls may be uni- or multilocular, the individual larvae excavating slender, subcortical channels some 7 mm or more in length.

Larva. Length 4 mm, stout, deep orange. Head small, obtusely triangular, the antennae long, obtusely conical; breastbone (Fig. 94) large, stout, heavily chitinized, tridentate; the submedian teeth large, obtusely rounded; the median tooth shorter, narrowly rounded; anterior angles of the breastbone greatly produced, heavily chitinized

Fig. 94 Sackenomyia packardi; ventral view of larval head and breastbone, enlarged (original)

and with a series of 4 to 6 or 7 minor teeth, the sublateral tooth being almost as large as the normal submedian tooth. The shaft is heavily chitinized, slightly crooked and with a moderate lateral expansion at the posterior extremity. Skin coarsely shagreened.

Exuviae. Length 2 mm, the whitish, chitinous process at the base of the antennae heavy, long and irregularly bidentate, the antennal cases extending to the first abdominal segment, the wing cases to the third and the leg cases to the third and fourth abdominal segments, the dorsum of the latter thickly set with minute, chitinous points; posterior extremity broadly rounded.

Male. Length 2.75 mm. Antennae extending to the third abdominal segment, sparsely haired, fuscous yellowish; 22 segments, the fifth with a stem one-fourth the length of the cylindric basal

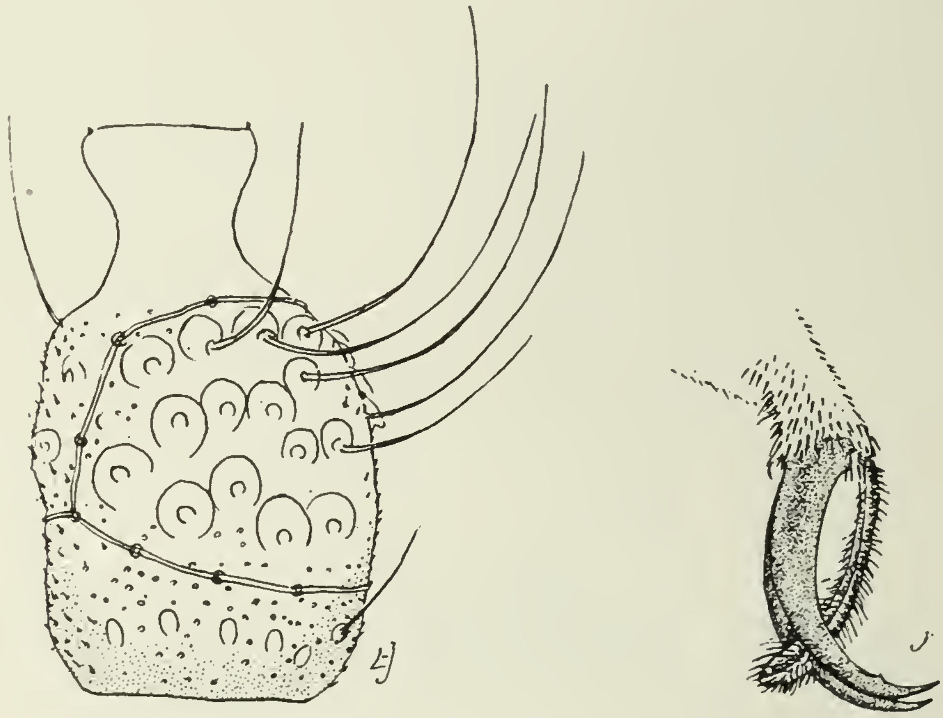


Fig. 95 Sackenomyia packardi; fifth antennal segment and claw of male, enlarged (original)

enlargement, which latter has a length twice its diameter; terminal segment reduced, tapering, narrowly rounded. Palpi; the first segment short, stout, the second narrowly oval. Mesonotum dark reddish brown, the submedian lines thickly black haired. Scutellum dark orange, fuscous basally, postscutellum dark orange. Abdomen sparsely clothed with fuscous hairs, dark red; genitalia very large, fuscous yellowish. Wings hyaline, costa dark brown. Halteres pale yellowish basally, reddish and sparsely fuscous haired apically. Coxae and legs a variable fuscous yellowish; claws stout, s ightly curved; the pulvilli nearly as long as the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment swollen; dorsal plate very broad, slightly emarginate; ventral plate long, slender, deeply and narrowly emarginate; harpes very long, slender, rodlike apically.

Female. Length 3.5 mm. Antennae extending to the second abdominal segment, sparsely haired, yellowish brown; 21 subsessile segments, the fifth with a length twice its diameter; cylindric; terminal segment slightly reduced, broadly oval. Palpi; the first segment irregular, incrassate, the second segment with a length four times its diameter, fusiform. Mesonotum dull brown, the submedian lines sparsely haired. Scutellum and postscutellum reddish brown. Abdomen mostly deep red, the segments variably margined with fuscous posteriorly, the seventh and eighth segments inflated, fuscous yellowish; ovipositor dull orange distally. Legs mostly

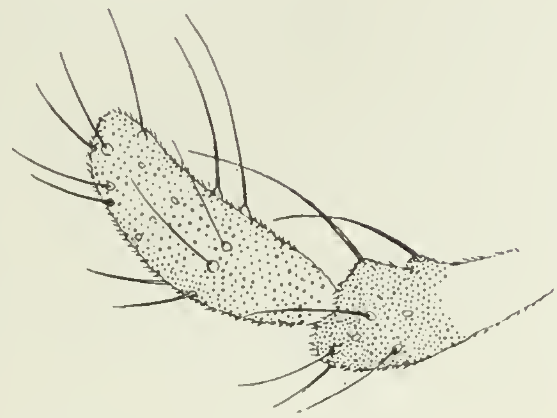


Fig. 96 Sackenomyia packardi; palpus of female, enlarged (original)

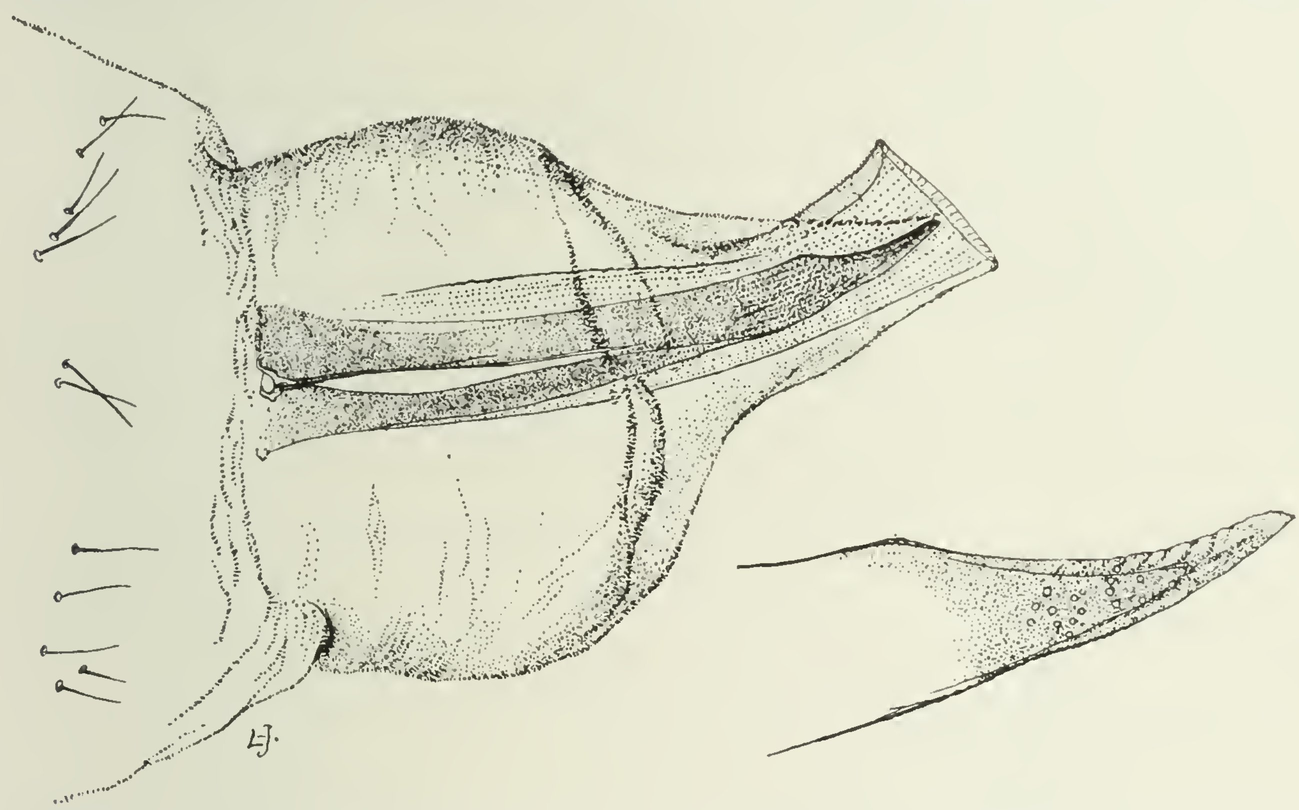


Fig. 97 Sackenomyia packardi; apex of abdomen with tip more enlarged, enlarged (original)

a dull black. Ovipositor about one-third the length of the abdomen, the terminal portion heavily chitinized, cultriform. Type Cecid. a1934.

Walshomyia Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 359–60
1910 **Rubsaamen, E. H.** Zeitsch. Wissenschaft. Insektenbiol., 15: 337
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19: 47
1913 **Kieffer, J. J.** Gen. Insect., fasc. 152, p. 43

The genus is a connecting link between Rhopalomyia and Rhabdophaga. There are 18 or 19 antennal segments, those of the male distinctly stalked, with but one palpal segment and simple claws. It is separated from the former by the terminal clasp segment of

the male being distinctly prolonged, not swollen and strongly fusiform as in Rhopalomyia. The structure of the dorsal plate, ventral plate and genitalia approach that of Rhabdophaga. The pulvilli are remarkably long, being nearly twice the length of the claws. The female has the terminal segment distinctly enlarged to form a subtriangular apical process (figure 101) instead of the much prolonged ovipositor of Rhopalomyia. Type W a l s h o m y i a j u n i p e r i n a Felt.

Walshomyia juniperina Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 360–61, 365, 367

Both sexes of this species were reared June 19, 1884 from the fruit of J u n i p e r u s c a l i f o r n i c a taken at New Indria, Cal. The female of this species is remarkable because of the enlarged subtriangular form of the ovipositor.

Gall. The gall from which this species was reared is nearly 1 cm in length, .5 cm in diameter, purplish brown, hollow, the free end with three or four conspicuous diverging lobes.

Male. Length 1.5 mm. Antennae probably extending to the fourth abdominal segment, thickly haired, light reddish brown; 18 segments, the third and fourth narrowly fused, the fifth with a stem one-half the length of the subcylindric basal enlargement, which latter has a length one-half greater than its diameter and

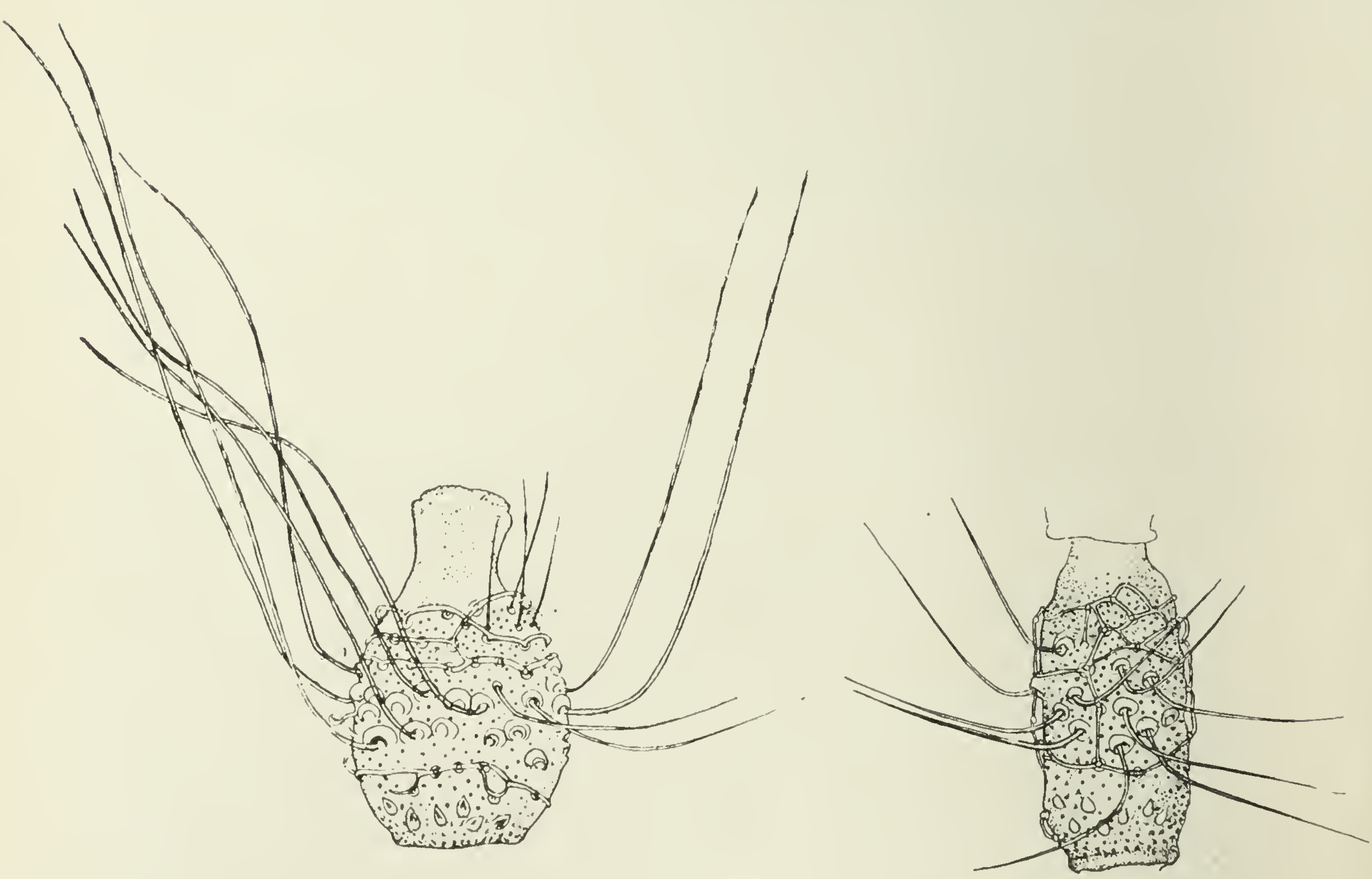


Fig. 98 W a l s h o m y i a j u n i p e r i n a; male and female antennal segments, much enlarged (author's illustration)

tapers slightly at both extremities; terminal segment prolonged with a length two and one-half times its diameter, obtusely rounded. Palp; one long, rather broad segment, broadly rounded apically. Mesonotum light reddish brown. Scutellum reddish yellow, postscutellum a little darker. Abdomen dark reddish brown; the genitalia greatly enlarged, reddish yellow. Wings hyaline, costa light brown, subcosta uniting with the margin at the basal half, the third vein a little before the apex, the fifth at the distal third, its branch at the basal third. Halteres yellowish basally, slightly fuscous apically. Legs a somewhat variable fuscous yellowish; claws rather short, stout, evenly curved, simple; the pulvilli nearly twice the length of the claws. Genitalia; basal clasp segment very short, broad; terminal clasp segment rather long, relatively slender, swollen basally; dorsal plate short, broad, broadly and triangularly emarginate; the lobes widely separated, tapering, narrowly rounded; ventral plate long, broad, truncate, with a rounded lateral expansion near the basal third. Harpes long, convolute, narrowly rounded.

Female. Length 2 mm. Antennae extending to the third abdominal segment, thickly haired, light reddish brown; 16 or 17 segments, the fifth with a length two and one-half times its diameter; terminal segment slightly prolonged, obtusely rounded and more or less fused with the preceding segment. Palp; one stout, irregularly oval segment. Mesonotum dark reddish brown, the submedian lines indistinct, yellowish. Scutellum reddish yellow, postscutellum reddish brown. Abdomen shining, rather dark reddish brown. Wings narrower and somewhat more pubescent than in the male.

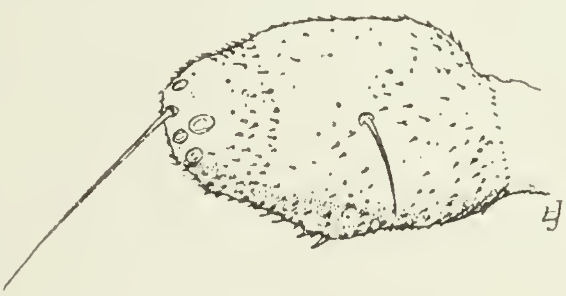


Fig. 99 Walshomyia juniperina; female palp, enlarged (original)

Fig. 100 Walshomyia juniperina; palp and claw much enlarged (author's illustration)

Fig. 101 Walshomyia juniperina; dorsal view of ovipositor, much enlarged (author's illustration)

Halteres and legs practically as in the opposite sex; terminal segment enlarged as a roundly triangular appendage having a length about equal to that of a normal segment, the anterior margin with a median round emargination; lateral margins broadly rounded, the distal narrowly so; ventrally at the posterior third there is a median pair of subtriangular plates, the dorsal one with a length one-half greater than its diameter, the ventral one-fourth the length of the dorsal, broadly rounded posteriorly. Type Cecid. 1049.

EXPLANATION OF PLATES

PLATE I

1 *Arphia pseudonietana* Thom., a close relative of the sulphur-winged grasshopper, *A. sulphurea* Fabr., a rather common species frequently associated with the next species

2 Carolina grasshopper, *Dissosteira carolina* Linn.

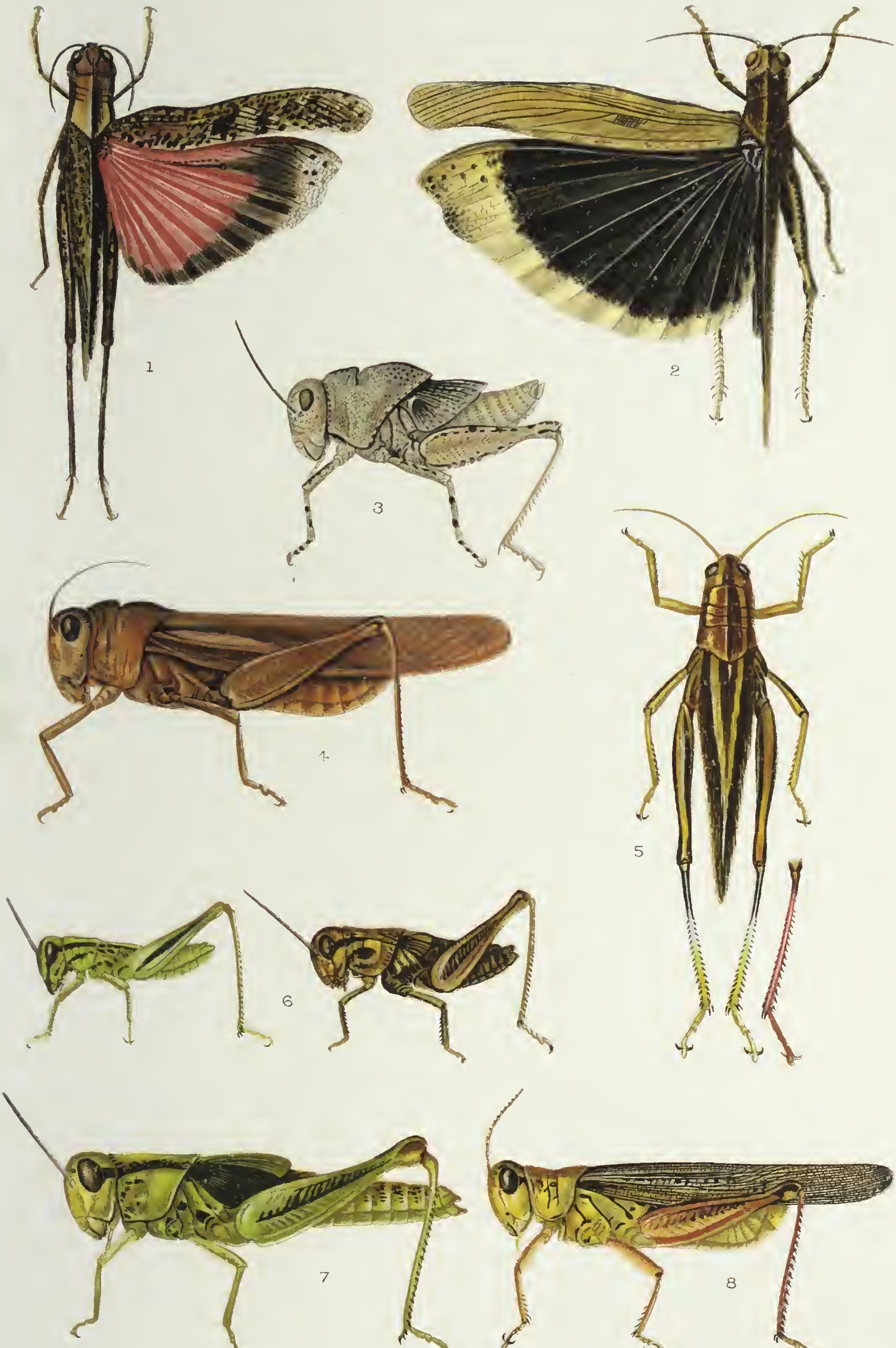
3 Young or nymph of the Carolina grasshopper

4 A color variety of the Carolina grasshopper

5 Two-striped grasshopper, *Melanoplus femoratus* Burm.; beside it is also shown a red tibia, a coloration sometimes found in this species

6, 7 Three nymphs or immature stages of the two-striped grasshopper

8 Red-legged grasshopper, *Melanoplus femur-rubrum* DeG., one of the commonest of our grasshoppers and resembling very closely the lesser red-legged grasshopper, *M. atlanis* Riley, the species so destructive in the foothills of the Adirondacks



L. L. WOOD, del.

A HOEN & CO. BALTIMORE

SOME COMMON GRASSHOPPERS

(COURTESY OF F. L. WASHBURN, MINNESOTA STATE ENTOMOLOGIST)

PLATE 2

1 Box leaves showing the galls and empty pupal cases of the Box leaf midge, Monarthropalpus buxi Lab.

2 Rye head with most of the kernels half eaten by the lesser red-legged grasshopper, Melanoplus atlanis Riley.

3 The European hornet, Vespa crabro Linn.

4 Birch twig showing areas denuded of bark by the European hornet, Vespa crabro Linn.

5 Portion of a pine needle infested with the pine leaf scale insect, Chionaspis pinifoliae Fitch.

Plate 2

Insects and insect work

PLATE 3

1 Oak twig showing work of the oak and maple twig pruner, Elaphidion villosum Fabr.

2 Spruce twig infested with the spruce bud scale, Physokermes piceae Schr.

3 Pine shoot injured by the European Pine-Shoot Moth, Evetria buoliana Schiff. Note particularly the series of blasted buds at the base of the one moderately vigorous shoot.

Plate 3

1

2

3

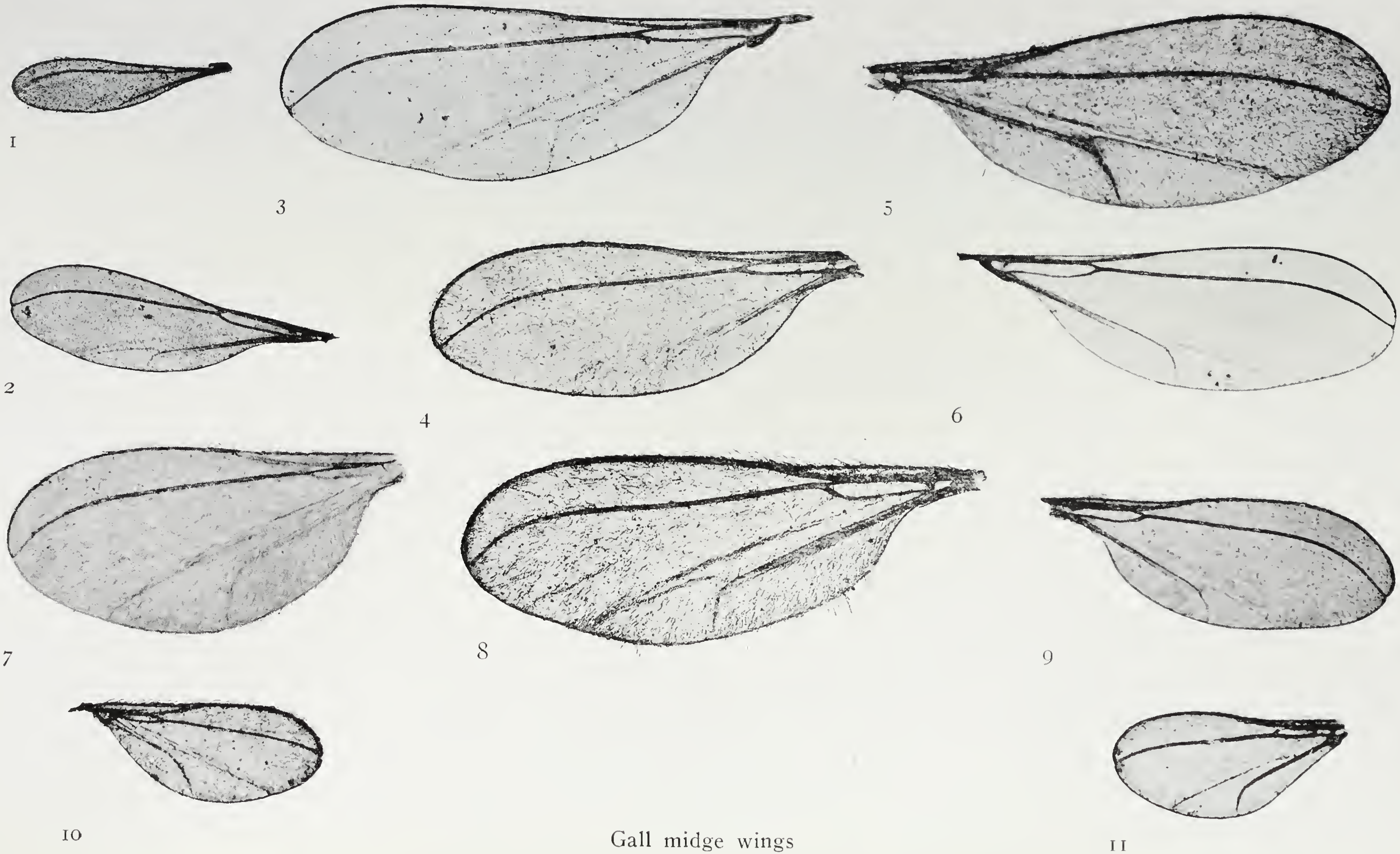
Insects and insect work

PLATE 4

Gall midge wings

1 Wing of Colpodia trifolii Felt, C. 455, x 20
2 Wing of Colpodia carolinae Felt, C. a1624, x 20
3 Wing of Porricondyla hamata Felt, C. a1626, x 20
4 Wing of Holoneurus altifilus Felt, C. 398, x 20
5 Wing of Camptomyia multinoda Felt, C. 789, x 20
6 Wing of Porricondyla carolinae Felt, C. a1625, x 20
7 Wing of Asynapta cerasi Felt, C. 236, x 20
8 Wing of Dirhiza canadensis Felt, C. 952, x 15
9 Wing of Porricondyla flava Felt, C. 151, x 20
10 Wing of Winnertzia karnerensis Felt, C. 395, x 20
11 Wing of Winnertzia ampelophila Felt, C. 450, x 20

Plate 4



Gall midge wings

PLATE 5

Gall midge genitalia

1 Genitalia of Colpodia carolinae Felt, C. a1624, x 260
2 Genitalia of Colpodia pinea Felt, C. a1622, x 260
3 Genitalia of Colpodia diervillae Felt, C. 485, x 260
4 Genitalia of Winnertzia solidaginis Felt, C. 508, x 260
5 Genitalia of Didactylomyia longimana Felt, C. 830, x 260

Plate 5

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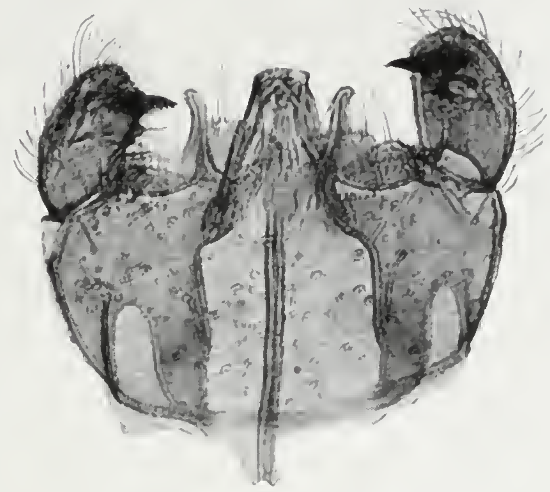

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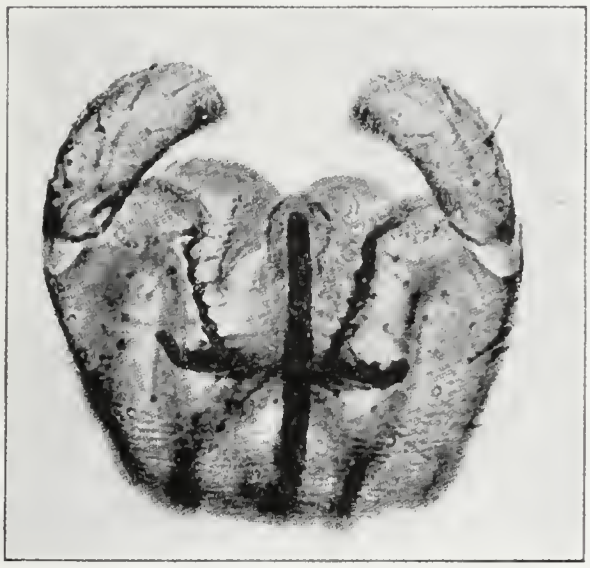

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Gall midge genitalia

PLATE 6

Gall midge genitalia

Genitalia of Porricondyla pini Felt, C. 221, x 260

Genitalia of Porricondyla hamata Felt, C. a1626, x 260

Plate 6

I

2

Gall midge genitalia

PLATE 7

Gall midge genitalia

1 Genitalia of Holoneurus multinodus Felt, C. 528, x 160

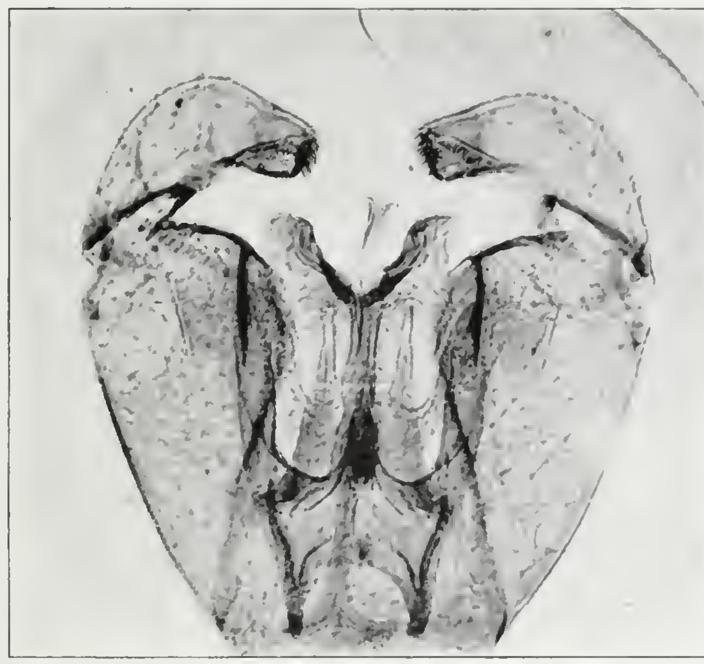
2 Genitalia of Holoneurus photophilus Felt, C. 119, x 160

3 Genitalia of Asynapta cerasi Felt, C. 263, x 260

4 Genitalia of Camptomyia multinoda Felt, C. 789, x 160

Plate 7

1



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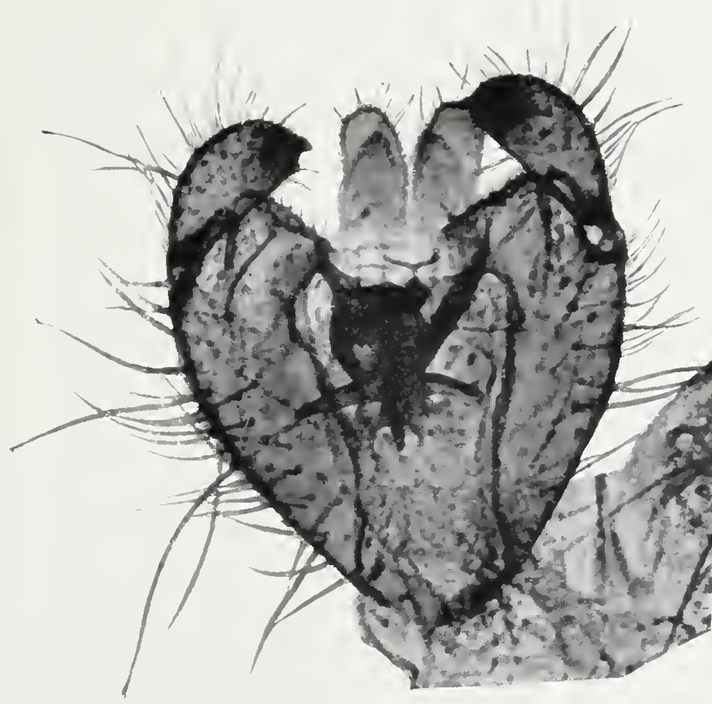


3

Gall midge genitalia

PLATE 8

Aerial galls of R. *hirtipes* O. S., upper and lateral views, also both aspects shown in section

Plate 8

Aerial galls of Rhopalomyia hirtipes

PLATE 9

1, 2 Subterranean galls of Rhopalomyia hirtipes O. S.
3 Gall of Janetiella asplenifolia Felt

Plate 9

1

2

3

Midge galls

PLATE 10

307

1 Galls of Phytophaga rigidae O. S.
2 Gall of Rhopalomyia capitata Felt

Plate 10

1

2

Midge galls

PLATE 11

1 Galls of Rhopalomyia bulbula Felt
2 Galls of R. thompsoni Felt

Plate 11

1

2

Solidago galls

PLATE 12

1 Galls of *Phytophaga walshii* Felt

2 Aerial galls, mostly poorly developed, of *R. hirtipes* O. S.

Plate 12

1

2

Solidago galls

PLATE 13

1 Gall of *Rhopalomyia capitata* Felt
2 Another type of gall produced by the same species

Plate 13

1

2

Solidago galls

PLATE 14

1 Gall of *Rhopalomyia albipennis* Felt
2 Gall of *R. latiflori* Felt

Plate 14

2

Midge galls

PLATE 15

1 Gall of *Rhopalomyia anthophila* O. S.
2 Gall of *R. racemicola* O. S.

Plate 15

1

2

Midge galls

PLATE 16

1 Gall of *Rhopalomyia clarkei* Felt
2 Gall of *Sackenomyia viburnifolia* Felt

Plate 16

1

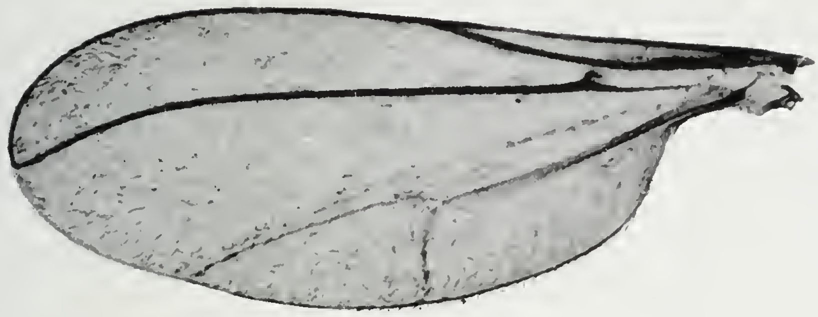
2

Midge galls

PLATE 17

1 Wing of Oliogotrophus species (x 20)
2 Wing of *Phytophaga rigidae* O. S. (x 20)
3 Wing of *Rhopalomyia fusiformis* O. S. (x 20)
4 Wing of *R. racemicola* O. S. (x 20)
5 Wing of *Phytophaga violicola* Coq. (x 20)
6 Wing of *P. thalictri* Felt (x 20)
7 Genitalia of *Janetiella nodosa* Felt (x 260)

Plate 17



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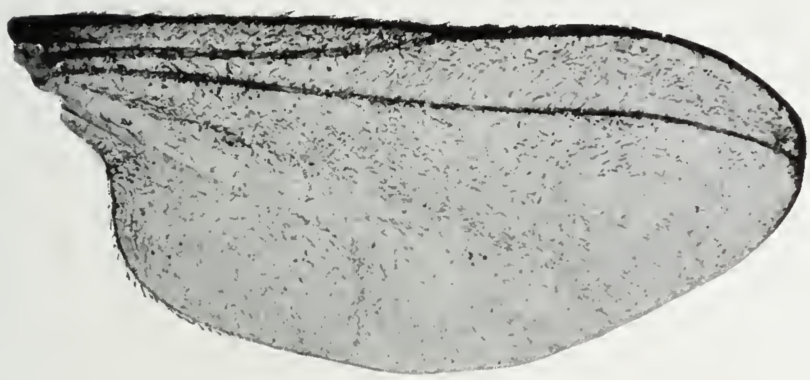

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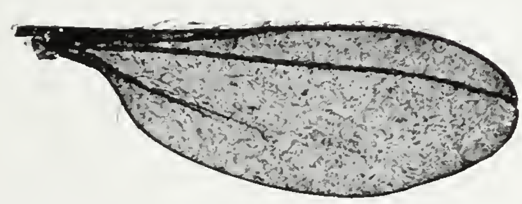

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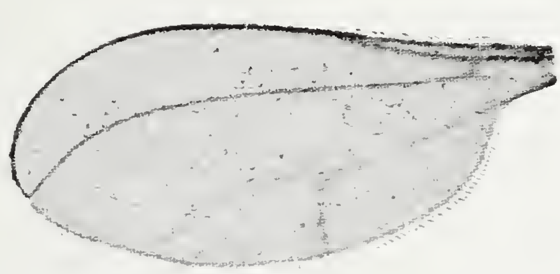

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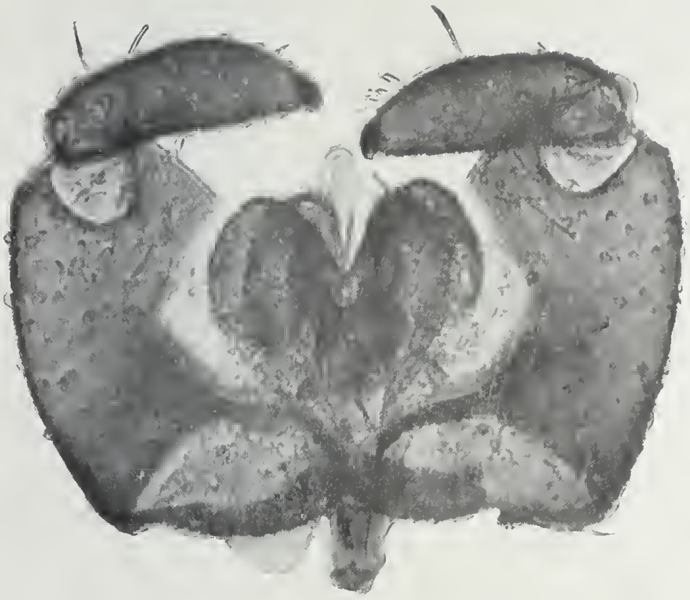
Gall midge structures

PLATE 18

1 Genitalia of P h y t o p h a g a d e s t r u c t o r Say (x 260)
2 Genitalia of R h o p a l o m y i a p i n i Felt (x 260)
3 Genitalia of R. u n i f o r m i s Felt (x 260)

Plate 18



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Gall midge genitalia

PLATE 19

1 Genitalia of *Rhopalomyia major* Felt (x 260)
2 Genitalia of *R. hirtipes* Felt (x 260)

Plate 19

1

2

Gall midge genitalia

INDEX

Appendix 3

Botany

Museum Bulletin 179

University of the State of New York Bulletin

Entered as second-class matter August 2, 1913, at the Post Office at Albany, N. Y.
under the act of August 24, 1912

Published fortnightly

No. 605 | ALBANY, N. Y. | December 15, 1915

New York State Museum

John M. Clarke, Director

Museum Bulletin 179

REPORT OF THE STATE BOTANIST 1914

The University of the State of New York

Science Department, June 14, 1915

Dr John H. Finley

President of the University

SIR:

I beg to transmit to you herewith the annual report of the State Botanist for the fiscal year 1914 and to recommend this for publication as a bulletin of the State Museum.

Very respectfully

JOHN M. CLARKE

Director

THE UNIVERSITY OF THE STATE OF NEW YORK

OFFICE OF THE PRESIDENT

Approved for publication this 17th day of June 1915

President of the University

University of the State of New York Bulletin

Entered as second-class matter August 2, 1913, at the Post Office at Albany, N. Y., under the act of August 12, 1912

Published fortnightly

No. 605 ALBANY, N. Y. DECEMBER 15, 1915

New York State Museum

JOHN M. CLARKE, Director

Museum Bulletin 179

REPORT OF THE STATE BOTANIST 1914

John M. Clarke
Director, Science Department

SIR:

I beg to communicate herewith my report on the work of the State Botanist for the fiscal year 1914.

Very respectfully
HOMER D. HOUSE
Acting State Botanist

Noteworthy contributions. The most important addition to the State herbarium during the past year is the gift by Professor Charles S. Sheldon of Oswego, of his entire herbarium, numbering over 15,000 specimens. Professor Sheldon's collection contains specimens from every state of the union as well as from Mexico, Canada and several European countries. The New York State collections, made chiefly by Professor Sheldon between the years 1877 and 1895, alone number 1020 specimens. A more detailed account of this collection will be found in another place.

Mr Simon Davis of Brookline, Mass., presented the herbarium with a collection of 60 species of fungi native of the eastern United States. A large number of interesting flowering plants and fungi have also been received from Dr W. Haydon of Marshfield, Ore.

Scientific investigations. The limited amount of time available for field work was spent chiefly in a reconnaissance of the vegetation and its ecological relations, about the eastern end of Oneida lake, a region of extensive sandy barrens, swamps and bogs, in addition to the interesting vegetation of the shores and shallow

waters. This study, it is hoped, will be brought to a close during the season of 1915. Observations were also made upon the vegetation of several of the sphagnum bogs of central New York. It is highly desirable that these observations be brought together in a formal way at some future time. New localities for certain rare species are reported under " Notes on Local Floras " and " New or Interesting Species of Fungi."

Exchanges. It has been found desirable to distribute as exchanges many of the duplicate fungi and flowering plants of the herbarium, thus enriching our collections and making available much valuable space heretofore occupied by the stored material. Exchanges have been effected with Mr G. Newodowski of Kiev, Russia, from whom the herbarium has received a valuable collection of fungi, chiefly parasitic leaf forms, native of eastern Europe and the Russian Caucasus. From Brother Victorin, of Longueuil, Quebec, has been received in exchange a large collection of flowering plants representing the flora of our northern border.

Condition of the collections. Further progress has been made in the arrangement of the herbarium and with minor exceptions the collections are now in permanent form. Although there is on hand considerable material stored away in more or less inaccessible bundles, nevertheless practically all the valuable material has now been labeled and placed in proper sequence in the herbarium and thus made available for study. This has resulted in a great increase in the value of the herbarium for purposes of scientific research and is correspondingly appreciable to the numerous botanists who have had occasion to consult the collections during the past year.

Additions to the herbarium. The number of specimens of New York State species which have been added to the herbarium from current collections during the past year is 675, from contributions 336, from the Sheldon herbarium 1020; a total of 2031 specimens. Of the total number of specimens received, 112 were new to the herbarium and 19 species are described as new to science. The extralimital specimens of the Sheldon herbarium number 13,382.

The number of those who have contributed specimens is 33. This includes those who have sent specimens merely for identification and which were desirable additions to the herbarium.

Identifications. The number of identifications made of specimens sent or brought to the office by inquirers is 556. The number of persons for whom these identifications were made was 151.

PLANTS ADDED TO THE HERBARIUM

New to the herbarium

Aecidium lampsanicolum *Tranzsch.*
" lini *Dearness & House*
Apargia hispida (*L.*) *Willd.*
Ascochyta clematidina *Thümen.*
Asterina leemingii *E. & E.*
Asteroma ribicolum *E. & E.*
Ballota nigra *Linn.*
Borago officinalis *Linn.*
Bolbitius variicolor *Atkinson*
Botryosphaeria berengeriana var. weigeliae *Rehm*
Carex incomperta *Bicknell*
Campanula trachelium *Linn.*
Cercospora teucrii *E. & K.*
" argychamniae *Dearness & House*
" namae *Dearness & House*
Chaenorrhinum minus (*L.*) *Lange*
Chamaesyce humistrata (*Engelm.*) *Small*
Cleone spinosa *Linn.*
Coleosporium euphrasiae (*Schum.*) *Wint.*
" tussilaginis (*Pers.*) *Lev.*
Coniophora arida (*Fr.*) *Cooke*
Coniosporium lumulosum *Sacc.*
Coronilla coronata *Linn.*
Cucurbitaria caraganae *Karst.*
" elongata (*Fr.*) *Grev.*
Curreya peckiana *Sacc.*
Cylindrocolla urticae (*Pers.*) *Bon.*
Cylindrosporium spigeliae *Dearness & House*
Cytospora phomopsis *Sacc.*
Elscholtzia cristata *Willd.*
Dendrophoma phyllogena *Sacc.*
Eutypella stefansa (*Pers.*) *Rehm.*
Glycyrrhiza lepidota *Pursh*
Graphiothecium phyllogenum (*Desm.*) *Sacc.*
Gymnopilus permollis *Murrill*
" subviridis *Murrill*
Harpographium magnum *Sacc.*
Hieracium pratense *Tausch.*
Laestadia galactina *Dearness & House*
Lactaria obnubilis *Lasch.*
Leptosphaeria houseana *Sacc.*
Macrophoma peckiana *Dearness & House*
Melampsora helicoscopiae (*Pers.*) *Cast.*
" klebahni *Bubak*
" laricis-epitea *Kleb.*
Melampsorella symphyti (*DC.*) *Bubak*
Melanoleuca subpessundata *Murrill*
Micropeltis pitya *Sacc.*
Myriophyllum farwellii *Morong*
Nothomyces nigricans *Sacc.*
Phoma houseana *Sacc.*
Phomopsis daturae (*R. & F.*) *Sacc.*
" viticola *Sacc.*
Phyllosticta baccharidis *Dearness & House*
" chenopodii *Sacc.*
" galactis (*Cooke*) *E. & E.*
" mauraudiae *Dearness & House*
" medeolae *Dearness & House*
" nyssae *Cooke House*
" oakesiae *Dearness & House*
" orobella *Sacc.*
" pachysandrae *Dearness & House*
" rhexiae *Dearness & House*
Placosphaeria campanulae (*DC.*) *Bäuml.*
" celtidis *Dearness & House*
" stellatarum *Sacc.*
Pleuodomus destruens *Harter*
Potentilla monspielensis *Linn.*
Puccinia acrophila *Sydow*
" annularis (*Strauss*) *Wint.*
" bardanae *Corda*
" baryi (*Berk. & Br.*) *Wint*
" coronifera *Kleb.*

Puccinia herniariae *Unger*
" junci (*Strauss*) *Wint.*
" oreoselini (*Strauss*) *Körn.*
" simplex (*Körn.*) *Erikss. & Henn.*
" smilacearum-digraphidis *Kleb.*
" tanaceti *DC.*
" tragopogonis (*Pers.*) *Corda*
Pucciniasturm articum (*Lagerh.*) *Tranz.*
Ramularia delphinii *Dearness & House*
Rhabdospora clarkeana *Sacc.*
Richardia scabra *Linn. f.*
Rubus vermontanus *Blanchard*
Septoria breviuscula *Sacc.*
" cydoniae *Fckl.*
" darlingtoniae *Dearness & House*
" erythraeae *Dearness & House*
" lobeliae *Pk.* var. lobeliae-inflatae *Sacc.*
Septoria tinctoria *Dearness & House*
" trautvetteriae *E. & E.*
Sphaerella populnea *Sacc.*
Sphaeropsis visci (*Sollm.*) *Sacc.*
" peckiana *Dearness & House*
Sporodesmium mucosum *Sacc.*
" pilulare *Sacc.*
Stagonosporopsis haloxyli *H. Sydow*
Stipa comata *Trin. & Rupr.*
Thyridium ceanothi *Dearness & House*
Urocystis agropyri (*Preuss*) *Schroet.*
Uromyces fulgens *Bubak*
" glycyrrhizae (*Rabenh.*) *P. Magn.*
" heliotropii *Svedinski*
" salsolae *Reichardt*
" scutellatus (*Rabenh.*) *P. Magn.*
Viola fimbriatula x septentrionalis *Brainerd*
" " x sororia *Brainerd*
" incognita var. forbesii *Brainerd*
Venturia gaultheriae *Ell. & Ev.*

Not new to the herbarium

Aecidium clematidis *DC.*
" euphorbiae *Gmel.*
" frangulae *Schum.*
" rubellum *Gmel.*
" houstoniatum *Schw.*
" urticae (*Schum.*) *Rabenh.*
" violae *Schw.*
Agrostis maritima *Lam.*
" perennans (*Walt.*) *Tuckerm.*
Alnus mollis *Fernald*
Amanita velatipes *Atkinson*
Amelanchier canadensis (*L.*) *Medic.*
" intermedia *Spach*
" laevis *Wiegand*
" sanguinea (*Pursh*) *DC.*
Ammodenia peploides (*L.*) *Rupr.*
Anemone riparia *Fernald*
Apocynum androsaemifolium *Linn.*
" sibiricum *Jacq.*
Arabis brachycarpa (*T. & G.*) *Britton*
Arenaria serpyllifolia *Linn.*
Argentina anserina (*L*) *Rydb.*
Aristolochia clematitis *Linn.*
Aronia nigra (*Willd.*) *Britton*
Asterina gaultheriae *M. A. Curtis*
Artemisia stelleriana *Bess.*
Athyrium acrostichoides (*Sw.*) *Diels*
" pycnocarpon (*Michx.*) *Tidestrom*
Bartonia virginica (*L.*) *B.S.P.*
Batrachium trichophyllum (*A. Gray*) *Bosch*
Blephariglottis blephariglottis (*Willd.*) *Rydb.*
" ciliaris (*L.*) *Rydb.*
Boehmeria cylindrica (*L.*) *Sw.*
Boletus aureus *Linn.*
Boletinus cavipes (*Opat.*) *Kalchb.*
Botrychium dissectum *Spreng.*
" neglectum *Wood*
" obliquum oneidense *Gilbert*
Botryosphaeria quercuum (*Schw.*) *Sacc.*
Cakile edentula (*Bigel.*) *Hook.*
Callitriche heterophylla *Pursh*
Campanula aparinoides *Pursh*

Camptosorus rhizophyllus (*L.*) *Link*
Carex abacta *Bailey*
" arctata *Boott*
" atratiformis *Britton*
" aurea *Nuttall*
" cristatella *Britton*
" disperma *Dewey*
" eburnea *Boott*
" exilis *Dewey*
" flava *Linn.*
" folliculata *Linn.*
" glareosa *Wahl.*
" gracillima *Schw.*
" howei *Mackenzie*
" hystricina *Muhl.*
" intumescens *Rudge*
" lanuginosa *Michx.*
" leersii *Willd.*
" leptalea *Wahl.*
" limosa *Linn.*
" lupulina *Muhl.*
" maritima *O. F. Mueller*
" muhlenbergii *Schk.*
" pennsylvanica *Lam.*
" pennsylvanica *Lam.*
" plantaginea *Lam.*
" prasina *Wahl.*
" pseudo-cyperus *Linn.*
" squarrosa *Linn.*
" stipitata *Muhl.*
" swanii (*Fern.*) *Mackenzie*
" torta *Boott*
" tribuloides *Wahl.*
" tuckermanni *Dewey*
" trisperma *Dewey*
" vesicaria *Linn.*
Cassia marylandica *Linn.*
Castilleja acuminata (*Pursh*) *Spreng.*
Celtis occidentalis *Linn.*
Cenangium populneum (*Pers.*) *Rehm.*
Cenchrus carolinianus *Walt.*
Centaurea masculosa *Lam.*
Centaurium centaurium (*L.*) *W. F. Wight*
Cercospora callae *Peck*
" absinthii (*Pk.*) *Sacc.*
" comari *Peck*
" dubia *Wint.*
Ceriomyces auriflammeus (*B. & C.*) *Murrill*
" bicolor (*Peck*) *Murrill*
Ceriomyces communis (*Bull.*) *Murrill*
" retipes (*B. & C.*) *Murrill*
" scaber (*Bull.*) *Murrill*
" subtomentosus (*L.*) *Murrill*
Cetraria islandica (*L.*) *Ash.*
Chlorosplenium aeruginascens (*Nye*) *Karst.*
Chiogenes hispidula (*L.*) *T. & G.*
Cintractia caricis (*Pers.*) *Magn.*
Cladosporium fulvum *Cooke*
Coeloglossum bracteatum (*Willd.*) *Parl.*
Coelopleurum actaeifolium (*Michx.*) *C. & R.*
Comarum palustre *Linn.*
Clitocybe brumealis *Fries*
" clavipes (*Pers.*) *Fries*
" compressipes *Peck*
" inversa *Scop.*
" sudorifica *Peck*
Collybia butyracea (*Bull.*) *Fries*
" dryophila (*Bull.*) *Fries*
" lentioides *Peck*
" platyphylla *Fries*
" radicata (*Relh.*) *Fries*
" striatipes *Peck*
" strictipes *Peck*
" velutipes (*Curt.*) *Fries*
Corallorhiza maculata *Raf.*
Corticium investiens (*Schw.*) *Bres.*
" mutatum *Peck*
Cornus alternifolia *Linn. f.*
Cortinarius castaneus (*Bull.*) *Fries*
" cinnabarinus *Fries*
" cinnamoneus (*L.*) *Fries*
" collintius *Fries*
" distans *Peck*
Cortinellus rutilans (*Schaeff.*) *P. Karst.*
Crepidotus fulvotomentosus *Peck*
Criosanthes arietina (*L.*) *House*
Crocanthemum canadense (*L.*) *Britton*
Cronartium ribicolum *Dietr.*
Cryptogramma stelleri (*Gmel.*) *Prantl.*
Cryptotaenia canadensis (*L.*) *DC.*
Cyperus engelmanni *Steud.*

Cyperus filiculmis *Vahl*
" inflexus *Muhl.*
Cythraea bulbosa (*L.*) *House*
Cytospora leucostoma *Sacc.*
Deconica bryophila *Peck*
Dianthera americana *Linn.*
Discosia maculicola *Gerard*
Diatrypella betulina (*Peck*) *Sacc.*
Dimerosporium balsamicola (*Peck*) *E. & E.*
Dothidea sambuci (*Pers.*) *Fr.*
Dothidella junci (*Fr.*) *Sacc.*
Draba arabisans *Michx.*
Drosera longifolia *Linn.*
Dryopteris dryopteris (*L.*) *Britton*
" goldiana (*Hook*) *A. Gray*
" clintoniana (*D. C. Eaton*) *Dowell*
" dilatata (*Hoffm.*) *A. Gray*
" intermedia (*Muhl.*) *A. Gray*
Eccilia flavida *Peck*
" subacus *Peck*
" watsoni *Peck*
Elymus arenarius *Linn.*
" australis *Scribn. & Ball.*
Empetrum nigrum *Linn.*
Epilobium lineare *Muhl.*
Entoloma cuspidatum *Peck*
" modestum *Peck*
" nidorosum *Fries*
" rhodopolium (*Bolt.*) *Fries*
" salmoneum *Peck*
" sinuatum (*Pers.*) *Fries*
" strictius *Peck*
Equisetum fluvitale *Linn.*
" hyemale intermedium *A. A. Eaton*
Eriophorum alpinum *Linn.*
" angustifolium *Roth.*
" callitrix *Cham.*
" gracile *Koch*
" viridi-carinatum (*Engelm.*) *Fern.*
" virginicum *Linn.*
Eutypella maclurae (*Ell. & Ev.*) *Ell.*
Exoascus cerasi *Fckl.*
" insititiae *Sadebeck*
" pruni *Fckl.*
Fomes fraxinophilus (*Peck*) *Sacc.*
Fuscoporia ferruginea (*Schrad.*) *Murrill*
Galera hypnorum (*Batsch.*) *Fries*
" laterita *Fries*
" tenera *Fries*
Galium labradoricum *Wiegand*
Geum macrophyllum *Willd.*
" rivale *Linn.*
Glenospora melioloides *Curt.*
Gloeosporium coryli (*Desm.*) *Sacc.*
" hepaticae *Peck*
" sassafras (*Cooke*) *E. & K.*
Gnomonia petiolophila (*Peck*) *Berl & Vogl.*
Godronia Cassandrae *Peck*
Gymnadenopsis clavellata (*Michx.*) *Rydb.*
Gymnoconia interstitialis (*Schlecht.*) *Lagh.*
Gymnopilus flavida (*Schaeff.*) *Murrill*
" sapinea (*Fries.*) *Murrill*
" spumosa (*Fries*) *Murrill*
" squalida (*Peck*) *Murrill*
Halenia deflexa (*J. E. Sm.*) *Griseb.*
Halerpestes cymbalaria (*Pursh*) *Greene*
Hapalopilus rutilans (*Pers.*) *Murrill*
Hebeloma discomorbidum *Peck*
" parvifructum *Peck*
" pascuens *Peck*
Hibiscus moscheutos *Linn.*
Hieracium pilosella *Linn.*
Hierochloe odorata (*L.*) *Wahl.*
Hydnum adustum *Schw.*
" ochraceum *Pers.*
Hydrastis canadensis *Linn.*
Hydrophyllum virginanum *Linn.*
Hymenochaete agglutinosum *Ellis*
Hymenula galii *Peck*
Hypericum ellipticum *Hook.*
" majus (*A. Gray*) *Britton*
Hypholoma appendiculatum
" candolleanum *Fries*
" delineatum *Peck*
" rugocephalum *Atkinson*
" fasciculare (*Huds.*) *Quel.*
Hypocrea richardsonii *B. & M.*

Hygrophorus conicus (*Scop.*) *Fries*
" puniceus *Fries*
Hysterium prostii *Duby*
Ibidium beckii (*Lindl.*) *House*
" gracile (*Bigel.*) *House*
" plantagineum (*Raf.*) *House*
Ilysanthes dubia (*L.*) *Barnhart*
Inonotus radiatus (*Sow.*) *Karst.*
Irpex fuscescens *Schw.*
Irpiciporus lacteus (*Schw.*) *Murrill*
Isotria verticillata (*Willd.*) *Raf.*
Juncus balticus var. littoralis *Engelm.*
" brevicaudatus (*Engelm.*) *Fernald*
Juniperus horizontalis *Moench*
" sibirica *Burgsd.*
Kalmia polifolia *Wang.*
Lactaria desceptiva *Peck*
" grisea *Peck*
" hygrophoroides *B. & C.*
" lignyota *Fries*
" oculata (*Peck*) *Burlingham*
Lathyrus maritimus (*L.*) *Bigel.*
" myrtifolius *Muhl.*
Lentinus haematopus *Berk.*
Leontodon hispidus *Linn.*
Lepargyraea canadensis (*L.*) *Greene*
Lepiota americana *Peck*
" metulaespora *B. & Br.*
Leptasea aizoides (*L.*) *Haw.*
Leptonia serrulata (*Pers.*) *Fries*
" subserrulata *Peck*
Leptosphaeria doliolum (*Pers.*) *De Not.*
Leptothyrium periclymeum (*Desm.*) *Sacc.*
Ligusticum scothicum *Linn.*
Limodorum tuberosum *Linn.*
Limonium carolinianum (*Walt.*) *Britton*
Limnorchis hyperborea (*L.*) *Rydb.*
Liparis loesellii (*L.*) *Richard.*
Lobelia kalmii *Linn.*
Lonicera hirsuta *Eaton*
" oblongifolia (*Goldie*) *Hook.*
Lophodermium pinastri (*Schrad.*) *Cher.*
Lychnis flos-cuculi *Linn.*
Lycopodium annotinum *Linn.*
" inundatum *Linn.*
" tristachyum *Pursh*
Lysias hookeri (*Torr.*) *Rydb.*
" marcophylla (*Goldie*) *House*
" orbiculata (*Pursh*) *Rydb.*
Lysiella obtusata (*Pursh*) *Rydb.*
Lysimachia punctata *Linn.*
" vulgaris *Linn.*
Lythrum salicaria *Linn.*
Marasmius elongatipes *Peck*
" tomentosipes *Peck*
Mariscus mariscoides (*Muhl.*) *Kuntze*
Marsonia juglandis (*Lib.*) *Sacc.*
Melanoleuca sejuncta (*Sow.*) *Murrill*
" transmutans (*Peck*) *Murrill*
" terraeolens (*Peck*) *Murrill*
Melampsora larici-populini *Kleb.*
" lini (*Pers.*) *Desm.*
" vacciniorum *Link.*
Melampsoropsis cassandrae (*P. & C.*) *Arthur*
Melogramma bulliardi *Tul.*
Mertensia maritima (*L.*) *S. F. Gray*
Microsphaeria divaricata (*Wallr.*) *Lev.*
Moneses uniflora (*L.*) *A. Gray*
Montia lamprosperma *Cham.*
Naematelia atrata *Peck*
Naias flexilis (*Willd.*) *Rost. & Sch.*
Naucoria autumnalis *Peck*
" christinae *Fries*
" firma *Peck*
" sphagnophila *Peck*
" vernalis *Peck*
Nolanea conica *Peck*
Nymphaea rubrodisca (*Morong*) *Greene*
" variegata (*Engelm.*) *G. S. Miller*
Nyssa sylvatica *Marsh.*
Ophrys australis (*Lindl.*) *House*
" convallarioides (*Sw.*) *W. F. Wight*
" cordata *Linn.*
Oryzopsis racemosa (*Sm.*) *Ricker*
Oxybaphus hirsutus (*Pursh*) *Sweet*
Panicum columbianum *Scribn.*
" meridionale *Ashe*

Paxillus atrotomentosus (*Batsch.*) *Fries*
Parnassia caroliniana *Michx.*
Paspalum muhlenbergii *Nash*
Pedicularis palustris *Linn.*
Pellaea atropurpurea (*L.*) *Link*
Peniophora cinerea (*Fries*) *Cooke*
Peridermium cerebrum *Peck*
" comptoniae (*Arthur*) *Orton & Adams*
Persicaria amphibia (*L.*) *S. F. Gray*
Peronospora effusa (*Grev.*) *Rabenh.*
" ficariae *Tul.*
" viciae (*Berk.*) *De Bary*
Phaeolus sistotremoides (*Alb. & Schw.*) *Murrill*
Phragmidium subcorticium (*Schrank*) *Wint.*
Phyllachora ulmi (*Dur.*) *Fckl.*
Phyllitis scolopendrium (*L.*) *Hoffm.*
Phyllosticta asiminae *E. & K.*
" lantanoidis *Peck*
" pirina *Sacc.*
" tumoricola *Peck*
" cruenta (*Fr.*) *Kickx.*
Plantago aristata *Michx.*
" borealis *Lange*
" decipiens *Barneous*
Plasmopara nivea *Schroet.*
" viticola (*B. & C.*) *Berlese & De Toni*
Plicatura faginea (*Schrad.*) *P. Karst.*
Pluteolus callistus *Peck*
Poa eminens *J. S. Presl.*
Podosphaeria oxycanthae (*DC.*) *De Bary*
" tridoctyla (*Wallr.*) *De Bary*
Pogonia ophioglossoides *Linn.*
Polemonium vanbruntiae *Britton*
Poria attenuata *Peck*
Polygala pauciflora *Willd.*
" viridescens *Linn.*
Potentilla pennsylvanica *Linn.*
" recta *Linn.*
Primula farinosa var. macropoda *Fernald*
" mistassinica *Michx.*
Propolis faginea (*Schrad.*)
Prunus cuneata *Raf.*
Pseudomanus tumefaciens *E. Sm. & Town.*
Puccinastrum pyrolae (*Pers.*) *Dietel*
Puccinella angustata (*R. Br.*) *Rand & Redfield*
Puccinia aegopodii (*Schum.*) *Link*
" anemonies-virginianae *Schw.*
" arenariae (*Schum.*) *Schroet*
" bromina *Erikss.*
" coronata *Corda*
" emaculata *Schw.*
" galii (*Pers.*) *Schw.*
" .lampsanae (*Schultz*) *Fckl.*
" menthae *Pers.*
" polygoni-amphibii *Pers.*
" phragmitis (*Schum.*) *Körn.*
" spergulae *DC.*
" triticina *Erikss.*
Pryola secunda *Linn.*
" uliginosa *Torrey*
Pyxidanthera barbulata *Michx.*
Ranunculus septentrionalis *Poir.*
Ramularia tulasnei *Sacc.*
" obovata *Fckl.*
Rhamnus alnifolia *L'Her.*
Rhexia virginica *Linn.*
Rhodiola rosea *Linn.*
Rhytisma ilicis-canadensis *Schw.*
Rosellinia glandiformis *Ell. & Ev.*
" aquilia (*Fr.*) *De Not.*
" ligniaria (*Grev.*) *Nits.*
" nutans (*C. & P.*) *Sacc.*
" subiculata (*Schw.*) *Sacc.*
Rostkovites subaureus (*Peck*) *Murrill*
Rubus hispidus *Linn.*
" setosus *Bigel.*
" triflorus *Rich.*
Russula foetens (*Pers.*) *Fries*
" lutea (*Huds.*) *Fries*
" modesta *Peck*
" ochrophylla *Peck*
" variata *Banning*
Sagina nodosa (*L.*) *Fenzl.*
Salicornia europea L. var. prostrata (*Pall.*) *Fern.*

Salix balsamifera *Barrett*
" candida *Fluegge*
" lucida *Muhl.*
" petiolaris *J. E. Smith*
" sericea *Marsh.*
Sanguisorba canadensis *Linn.*
Saururus cernuus *Linn.*
Schizonella melanogramma (*DC.*) *Schroet.*
Schmaltzia crenata (*Mill.*) *Greene*
Scirpus cyperinus (*L.*) *Kunth*
" americanus *Pers.*
" clintonii *A. Gray*
" paludosus *A. Nelson*
" rufus (*Huds.*) *Schrad.*
" rubrotinctus *Fernald.*
" validus *Vahl*
Scirrhia rimosa (*A. & S.*) *Fckl.*
Scrophularia leporella *Bicknell*
Sebacina pallida (*Schw.*) *Burt*
Senecio discoideus (*Hook.*) *Britton*
" pauperculus *Michx.*
" pseudo-arnica *Less.*
Septoria cornicola *Desm.*
" dalibardae *Peck*
" irregularis *Peck*
" ludwigiae *Cooke*
" poae-annuae *Bres.*
" podophyllina *Peck*
" polygalae *P. & C.*
" kalmiaecola (*Schw.*) *B. & C.*
" oenotherae *West.*
" ribis *Desm.*
" trillii *Peck*
" violae *West.*
" viridi-tingens *Curtis*
Serapias helleborine *Linn.*
Sibbaldiopsis tridentata (*Ait.*) *Rydb.*
Silene dichotoma *Ehrh.*
Solidago puberula *Nutt.*
" rugosa *Mill.*
" uliginosa *Nutt.*
Sparganium angustifolium *Michx.*
Spartina michauxiana *Hitchc.*
Sphacelotheca hydropiperis *DeBary*
Sphaerella colorata *Peck*
" gaultheriae *C. & P.*
Sphaerotheca castagnei *Lev.*
Sporocybe azaleae (*Peck*) *Sacc.*
Stachys aspera *Michx.*
Steironema ciliata (*L.*) *Raf.*
Stellaria borealis *Bigel.*
" humifusa *Rottb.*
" longifolia *Muhl.*
Stoisima cornuta (*Michx.*) *Raf.*
Stropharia stercoraria *Fries*
" semiglobata *Batsch.*
Streptopus roseus *Michx.*
Streptothrix fusca *Corda*
Suillellus frostii (*Russell*) *Murrill*
" luridus (*Schaeff.*) *Murrill*
Taphrina rhizophora *Johan.*
Thelephora pedicellata *Schw.*
" terrestris *Ehrh.*
Tilletia tritici (*Bjerk.*) *Wint.*
Tissa canadensis (*Pers.*) *Britton*
Trematosphaeria nuclearia (*De Not*) *Sacc.*
Triglochin maritima *Linn.*
" palustris *Linn.*
Triosteum aurantiacum *Bicknell*
Trillium cernuum *Linn.*
Trisetum spicatum (*L.*) *Richter*
Tubaria furfuracea *Pers.*
Urocystis anemones (*Pers.*) *Schroet.*
Uromyces caladii (*Schw.*) *Farlow*
" fabae (*Pers.*) *De Bary*
" ficariae (*Schum.*) *Lev.*
" dactylidis *Otth.*
" geranii (*DC.*) *Otth. & Wartm.*
" minor *Schroet.*
" pisi (*Pers.*) *De Bary*
" rumicis (*Schum.*) *Winter*
" scrophulariae (*Schum.*) *B. & Br.*
Ustilago longissima (*Sow.*) *Tul.*
Utricularia intermedia *Hayne*
" macrorrhiza *LeConte*
Vaccinium angustifolium *Ait.*
" atrococcum (*A. Gray*) *Heller*
" corymbosum *Linn.*
" pennsylvanicum *Lam.*
Vagnera trifolia (*L.*) *Morong*
Valeriana uliginosa (*Torr. & Gray*) *Rydb.*

Valsa leucostoma (*Pers.*) *Fries*
" brevis *Peck*
Veratrum viride *Ait.*
Vermicularia hepatica *Peck*
" coptina *Peck*
" peckii *Sacc.*
Veronica chamaedrys *Lynn.*
Viola incognita *Brainerd*
" rotundifolia *Michx.*
" selkirkii *Goldie*
Viola septentrionalis *Greene*
" sororia *Willd.*
Vitis-idaea vitis-idaea (*L.*) *Britton*
Waldsteinia fragarioides (*Michx.*) *Tratt.*
Washingtonia claytoni (*Michx.*) *Britton*
Zannichella palustris *Linn.*
Zizia aurea (*L.*) *Koch*
Zostera marina *Linn.*

CONTRIBUTORS AND THEIR CONTRIBUTIONS

Frank H. Ames, Brooklyn

Entoloma sinuatum *Fries*
Hypholoma candolleanum *Fries*

M. S. Baxter, Rochester

Agrostis perennans (*Walt.*) *Tuckerm.*
Carex squarrosa *Linn.*
" tuckermanni *Dewey*
Cyperus engelmanni *Steud.*
Festuca elatior arundinacea *Celak*
Oryzopsis racemosa (*Sm.*) *Richter*
Centaurea maculosa *Lam.*
Scrophularia leporella *Bicknell*
Paspalum muhlenbergii *Nash*
Stipa comata *Trin. & Rupr.*

Louis A. Blodgett, Schoharie

Campanula trachelium *Linn.*
Polemonium van-bruntiae *Britton*

Rev. Charles W. Boyd, Tupper Lake

Clavaria ligula *Fries*

Miss Elizabeth L. Bradley, Troy

Aristolochia clematitis *Linn.*

Ezra Brainard, Middlebury, Vt.

Rubus setosus *Bigel.*
Rubus vermontanus *Blanchard*

John N. Brown, Ogdensburg

Lentinus lepideus *Fries*
Phaeolus sistotremoides (*A. & S.*) *Schw.*

S. H. Burnham, Hudson Falls

Cetraria islandica (*L.*) *Ach.*
Marasmius tomentosipes *Peck*
Trematosphaeria nuclearia (*De Not.*) *Sacc.*

Miss M. C. Burns, Middleville

Lepiota americana *Peck*

J. H. Ten Eyck Burr, Cazenovia

Lactaria deceptiva *Peck*

Mrs Loomis Burrill, Little Falls

Serapias helleborine *Linn.*

Simon Davis, Brookline, Mass.

Bolbitius variicolor *Atkinson*
Collybia butyracea (*Bull.*) *Fries*
" lentinoides *Peck*
" striatipes *Peck*
" strictipes *Peck*
Clitocybe brumalis *Fries*
" compressipes *Peck*
" sudorifica *Peck*
Cortinarius cinnabarinus *Fries*
" cinnamoneus (*L.*) *Fr.*
" collinitus *Fries*
Crepidotus fulvotomentosus *Peck*
Deconica bryophila *Peck*
Eccilia flavida *Peck*
" subacus *Peck*
" watsoni *Peck*
Entoloma cuspidatum *Peck*
" modestum *Peck*
" nidorosum *Fries*
" rhodopolium (*Bolt.*) *Fries*
" salmoneum *Peck*
" sinuatum (*Pers.*) *Fries*
" strictius *Peck*
Flammula flavida (*Schaeff.*) *Fr.*
" spumosa *Fries*
" squalida *Peck*
Galera hypnorum (*Batsch.*) *Fries*
" laterita *Fries*
" sphagnorum *Pers.*
" tenera *Fries*
Hebeloma discomorbidum *Peck*
" parvifructum *Peck*
Hygrophorus conicus (*Scop.*) *Fries*
Hypholoma delineatum *Peck*
" rugocephalum *Atkinson*
Leptonia serrulata (*Pers.*) *Fries*
" subserrulata *Peck*
Lepiota metulaespora *Berk. & Br.*
Lactaria grisea *Peck*
" lignyota *Fries*
Marasmius varicosus *Fries*
Melanoleuca sejuncta (*Sow.*) *Murrill*
" terraecolens (*Peck*) *Murrill*
" transmutans (*Peck*) *Murrill*
Mycena alcalina *Fries*
Naucoria autumnalis *Peck*
" firma *Peck*
" christinae *Fries*
" sphagnophila *Peck*
" tabacina bicolor *Peck*
Nolanea conica *Peck*
Paxillus atrotomentosus (*Batsch.*) *Fries*
Pholiota togularis (*Bull.*) *Kickx*
Pluteolus expansus *Peck*
" callistus *Peck*
Psathyra helobina *Kalchbr.*
Sebacina pallida (*Schw.*) *Burt*

John Dearness, London, Ontario

Cladosporium fulvum *Cooke*
Gymnosporangium juniperi-virginianae *Schw.*
Hymenula galii *Peck*
Marsonia juglandis (*Lib.*) *Sacc.*
Melampsoropsis cassandrae (*P. & C.*) *Arthur*
Propolis faginea (*Schrad.*) *Karst.*
Puccinia bardanae *Corda*
" emaculata *Schw.*
Pucciniastrum arcticum (*Lagerh.*) *Trans.*

W. T. Doherty, Canille, Ariz.

Fomes fraxinophilus (*Peck*) *Sacc.*
Peridermium cerebrum *Peck*

G. H. French, Carbondale, Ill.

Coriolus prolificans (*Fr.*) *Murrill*
Hapalopilis rutilans (*Pers.*) *Murrill*

W. J. French, Syracuse
Hibiscus moscheutos *Linn.*

L. L. Harter, Washington, D. C.
Pleuodomus destruens *Harter*

Dr M. T. Hutton, Putnam Station
Lepiota naucinioides *Peck*

J. M. Van Hook, Bloomington, Ill.

Rosellina aquilia (*Fries*) *De Not*
" glandiformis *Ell. & Ev.*
" ligniaria (*Grev.*) *Nits.*
" medullaris (*Wallr.*) *Ces. & De Not.*
" nutans (*C. & P.*) *Sacc.*
" palustris *Schroet.*
" pulveracea (*Ehrh.*) *Fckl.*
" subiculata (*Schw.*) *Sacc.*

Dr W. Haydon, Marshfield, Ore.

Boletinus cavipes (*Opat.*) *Kalchb.*
Argentina anserina (*L.*) *Rydb.*
Baccharis pilularis *DC.*
Cantharellus cibarius *Fries*
Clitocybe clavipes (*Pers.*) *Fries*
" inversa *Scop.*
Cercospora absinthii (*Peck*) *Sacc.*
Collybia velutipes (*Curt.*) *Fries*
Darlingtonia californica *Torrey*
Fragaria chiloensis (*L.*) *Duch.*
Gnaphalium chilense *Spreng.*
Gymnopilus permollis *Murrill*
Hosackia gracilis *Dougl.*
Hygrophorus inmutans *Murrill*
Hypholoma fasciculare (*Huds.*) *Quel.*
Melanoleuca subpessundata *Murrill*
Opulaster cordatus *Rydb.*
Plantago purshii *R. & B.*
Stropharia stercoraria *Fries*
Vancouveria hexandra (*Hook.*) *Morr. & Dec.*

Jackson & Perkins, Newark
Pseudomonas tumefaciens *E. Sm. & Town.*

C. E. Jenny, Fresno, Calif.
Lenzites trabea *Fries*

Charles A. Mabie, Holley
Lentinus lepideus *Fries*

Miss M. McKenny, Olympia, Wash.
Gymnopilus subviridis *Murrill*

Miss A. G. Moore, Monroe
Craterellus cantharellus (*Schum.*) *Fries*

G. Newodowski, Kiev, Russia

Aecidium clematidis *DC.*
" euphorbiae *Gmel.*
" frangulae *Schum.*
Aecidium lampsanicolum *Tranzschel*
" rubellum *Gmel.*
" urticae (*Schum.*) *Rabent.*

Albugo candida (*Pers.*) *Kuntze*
Botryosphaeria berengeriana var. weigeliae *Rehm.*
Cercospora dubia *Wint.*
Coleosporium euphrasiae (*Schum.*) *Wint.*
" tussilaginis *Pers.*
Cronartium rubicolum *Dietr.*
Cucurbitaria caraganae *Karst.*
" elongata (*Fr.*) *Grev.*
Cylindrocolla urticae (*Pers.*) *Bon.*
Erysiphe polygoni *DC.*
" tortilis (*Wallr.*) *Fr.*
" umbelliferarum *DeBary*
Eutypella maclurae (*E. & E.*) *Ell.*
" stefansa (*Pers.*) *Rehm.*
Exoascus cerasi *Fckl.*
" insititiae *Sadebeck*
" pruni *Fckl.*
Graphiothecium phyllogenum (*Desm.*) *Sacc.*
Gymnosporangium juniperinum (*L.*) *Fries*
Leptosphaeria doliolum (*Pers.*) *De Not.*
Melampsora helioscopiae (*Pers.*) *Cast*
" larici-epitea *Kleb.*
" larici-populini *Kleb.*
" lini (*Pers.*) *Desm.*
" klebahni *Bubak*
" vacciniorum *Link*
Melampsorella symphyti (*DC.*) *Bubak*
Melogramma bulliardi *Tul.*
Microsphaeria divaricata (*Wallr.*) *Lev.*
Peronospora alta *Fckl.*
" effusa (*Grev.*) *Rabenh.*
" ficariae *Tul.*
" viciae (*Berk.*) *DeBary*
Phragmidium subcorticium (*Schrank*) *Wint.*
Placosphaeria campanulae (*DC.*) *Bauml.*
" stellatarum *Sacc.*
Plasmopara nivea *Schroet.*
" viticola (*B. & C.*) *Berlese & DeToni*
Podosphaeria oxycanthae (*DC.*) *DeBary*
" tridactyla (*Wallr.*) *DeBary*
Puccinia acrophila *Sydow*
" aegopodii (*Schum.*) *Link*
" anemones-virginianae *Schw.*
" annularis (*Strauss*) *Wint.*
" arenaeiae (*Schum.*) *Schroet*
" argentata (*Schultz*) *Wint.*
" bardanae *Corda*
" baryi (*Ber. & Br.*) *Wint.*
" bromina *Erikss.*
" coronata *Corda*
" coronifera *Kleb.*
" galii (*Pers.*) *Schroet.*
" herniariae *Unger*
" junci (*Strauss*) *Wint.*
" lampsanae (*Schultz*) *Fckl.*
" menthae *Pers.*
" oreoselini (*Strauss*) *Körn.*
" phragmites (*Schum.*) *Körn.*
" polygoni-amphibü *Pers.*
" smilacearum-digraphidis *Kleb.*
" spergulae *DC.*
" taneceti *DC.*
" tragopogonis (*Pers.*) *Corda*
" triticina *Erikss.*
Schizonella melanogramma (*DC.*) *Schroet.*
Scirrhia rimosa (*Alb. & Schw.*) *Fckl.*
Septoria cynodontia *Fckl.*
" poae-annuae *Bres.*
Sphacelotheca hydropiperis *De Bary*
Sphaeropsis visci (*Solim.*) *Sacc.*
Sporodesmium mucosum *Sacc.*
Staganosporopsis haloxyli *Sydow*
Streptothrix fusca *Corda*
Taphrina rhizophora *Johans.*
Tilletia tritici (*Bjerk.*) *Wint.*
Uromyees dactylidis *Otth.*
" fabae (*Pers.*) *DeBary*
" ficaraie (*Schum.*) *Lev.*
" glycyrrhizae (*Rabenh.*) *P. Magn.*
" heliotropii *Svedinski*
" pisi (*Pers.*) *DeBary*
" rumicis (*Schum.*) *Wint.*

Uromyees scrophulariae (*Schum.*) *B. & Br.*
" scutellatus (*Rabenh.*) *P. Magn.*
" salsolae *Reichardt*
Urocystis agropyri (*Preuss*) *Schroet.*
" anemones (*Preuss*) *Scop.*
Ustilago anomala *T. Kunze*
" longissima *Sow.*

F. M. Rolfs, Clemson College, S. C.

Thelephora pedicellata *Schw.*

T. E. Wilcox, Washington, D. C.

Ceriomyces auriflammeus (*B. & C.*) *Murrill*

Mrs A. Shantz, Old Forge

Leottia lubrica *Pers.*

E. B. Sterling, Trenton, N. J.

Ceriomyces bicolor (*Peck*) *Murrill*
" retipes (*B. & C.*) *Murrill*
" subtomentosus (*L.*) *Murrill*
Cortinarius castaneus (*Bull.*) *Fries*
Hebeloma pascuens *Peck*
Inonotus radiatus (*Sow.*) *Karst.*
Lepiota procera (*Scop.*) *Fries*
Suillellus frostii (*Russell*) *Murrill*

J. A. Sweigert, Plattsburg

Peridermium comptoniae (*Arthur*) *Orton & Adams*

Brother Victorin, Longueuil, Quebec

Alnus mollis *Fernald*
Amelanchier laevis *Wiegand*
Ammodenia peploides (*L.*) *Rupr.* var. robusta *Fern.*
Aquilegia canadensis *Linn.*
Anemone riparia *Fernald*
Arabis brachycarpa (*T. & G.*) *Britton*
Cakile edentule (*Bigel.*) *Hook.*
Capnoides sempervirens (*L.*) *Borkh.*
Carex arctata *Boott*
" atratiformis *Britton*
" glareosa *Wahl.*
" lanuginosa *Michx.*
" maritima *O. F. Mueller*
" vesicaria *Linn.*
Castilleja acuminata (*Pursh*) *Spreng.*
Coelopleurum actaeifolium (*Michx.*) *Coult. & Rose*
Coeloglossum bracteatum (*Willd.*) *Parl.*
Draba arabisans *Michx.*
Eleocharis palustris (*L.*) *R. & S.* var. glaucescens (*Willd.*) *Gray*
Elymus arenarius *Linn.*
Epilobium palustre *Linn.*
Empetrum nigrum *Linn.*
Erigeron hyssopifolius *Michx.*
Eriophorum alpinum *Linn.*
" angustifolium *Roth*
" gracile *Koch*
Fissipes acaule (*L.*) *Small*
Galium asperellum *Michx.*
Geum rivale *Linn.*
" macrophyllum *Willd.*
Halenia deflexa (*J. E. Sm.*) *Griseb.*
Halerpestes cymbalaria (*Pursh*) *Greene*
Hicoria ovata (*Mill.*) *Britton*
Hieracium pilosella *Linn.*
Hierochloe odorata (*L.*) *Wahl.*
Iris hookeri *Penny*

Juncus brevicaudatus (*Engelm.*) *Fern.*
" balticus *Willd.* var. littoralis *Engelm.*
Juniperus horizontalis *Moench*
" sibirica *Burgsd.*
Kalmia angustifolia *Linn.*
Limnorchis hyperborea (*L.*) *Rydb.*
Lathyrus pratensis *Linn.*
Ligusticum scothicum *Linn.*
Limonium carolinianum (*Walt.*) *Britton*
Lysimachia punctata *Linn.*
" terrestris (*L.*) *B. S. P.*
Lysiella obtusata (*Pursh*) *Rydb.*
Lysias hookeri (*Torr.*) *Rydb.*
" orbiculata (*Pursh*) *Rydb.*
Mertensia maritima (*L.*) *S. F. Gray*
Mitella nuda *Linn.*
Moehringia lateriflora (*L.*) *Fenzl.*
Moneses uniflora (*L.*) *A. Gray*
Montia lamprosperma *Cham.*
Oenothera muricata *Linn.*
Ophrys convallarioides (*Sw.*) *Wight*
" cordata *Linn.*
Dasiphora fruticosa (*L.*) *Rydb.*
Panicularia nervata (*Willd.*) *Kuntze*
Pedicularis canadensis *Linn.*
" palustris *Linn.*
Plantago boreale *Lange*
" decipiens *Barneous*
Poa eminens *J. S. Dresl.*
Potentilla pennsylvanica *Linn.*
Primula farinosa var. macropoda *Fernald*
Puccinella angustata (*R. Br.*) *Rand & Redfield*
Pyrola secunda *Linn.*
" uliginosa *Torrey*
Ranunculus septentrionalis *Poir.*
Rubus triflorus *Rich.*
Rumex obtusifolius *Linn.*
Salicornia europea var. prostrata (*Pall.*) *Fernald*
Salix balsamifera *Barratt*
Sagina nodosa (*L.*) *Fenzl.*
Sanguisorba canadensis *Linn.*
Saxifraga virginiensis *Michx.*
Scirpus americanus *Pers.*
" clintonii *A. Gray*
" cyperinus (*L.*) *Kunth*
" paludosus *A. Nels.*
" rubrotinctus *Fernald*
" rufus (*Huds.*) *Schrad.*
Senecio discoideus (*Hook.*) *Britton*
" pauperculus *Michx.*
" pseudo-arnica *Less.*
Stellaria borealis *Bigel.*
" humifusa *Rottb.*
Sparganium angustifolium *Michx.*
Spartina michauxiana *Hitchc.*
Streptopus roseus *Michx.*
Sibbaldiopsis tridentata (*Ait.*) *Rydb.*
Tissa canadensis (*Pers.*) *Britton*
Trientalis americana (*Pers.*) *Pursh*
Triosteum aurantiacum *Bicknell*
Trillium erectum *Linn.*
" grandiflorum *Salisb.*
Triglochin maritima *Linn.*
" palustre *Linn.*
Trisetum spicatum (*L.*) *Richter*
Vagnera racemosa (*L.*) *Morong*
" stellata (*L.*) *Morong*
Vaccinium angustifolium *Ait.*
" canadense *Kalm.*
" corymbosum *Linn.*
Viburnum lentago *Linn.*
Viola conspersa *Reichenb.*
Vitis-idaea vitis-idaea (*L.*) *Britton*
Washingtonia claytoni (*Michx.*) *Britton*
Zannichella palustris *Linn.*
Zizia aurea (*L.*) *Koch*
Zostera marina *Linn.*

D. B. Young, Albany

Naucoria vernalis *Peck*

THE HERBARIUM OF CHARLES S. SHELDON

BY HOMER D. HOUSE

The herbarium of Professor Charles S. Sheldon of Oswego, N. Y., was presented to the State Museum during the summer of 1914. The herbarium represents the botanical activity of a lifetime on the part of Professor Sheldon, numbering over 14,000 mounted specimens from every portion of the United States, Canada, Mexico and Europe. Several valuable exissicati are represented in the collection, including Pringle (Mexico), Curtis (Florida), Langlois (Louisiana) and several others.

Professor Charles S. Sheldon was born in Oswego, and received his early education in the public and high schools of that city. He was graduated from the Oswego Normal School in 1875. The next year was spent under Dr James Hall, arranging the State collection of minerals at Albany. From 1876 to 1880 Professor Sheldon was a student at Cornell University, from which he was graduated with honor. While at Cornell Professor Sheldon developed under Doctor Prentiss, then professor of botany, a love for the study of botany which resulted in the formation of an herbarium destined to become one of the largest private collections in the State.

For the next thirty-four years Professor Sheldon followed the profession of teaching, beginning with the public schools of Alexandria Bay, N. Y. (1881–83), then as head of the science department of the Missouri State Normal School at Kirkville, Mo. (1883–93), and the chair of biology in the State Normal School at Oswego, N. Y. (1893–1914).

During his years in Missouri, Professor Sheldon spent his summers botanizing in the western states and territories, Nevada and Utah being the only states not visited. His collections in this region represent nearly 1500 different species. After coming to Oswego his opportunities to collect became more limited and most of his spare moments were devoted to the mounting and systematizing of his collections and enlarging his hebarium by means of extensive exchanges, until the collection contained close to 20,000 specimens. Owing to insect depredations, many specimens were ruined, so that the collection at present contains about 15,000 good specimens, exclusive of about 300 duplicates.

The composition of Professor Sheldon's herbarium is shown in the following enumeration of the collectors whose collections are represented by mounted specimens:

C. G. Pringle, Mexico (2351), Arizona (195), Texas and California (20).	2566
Charles S. Sheldon, western states, chiefly from Colorado with some from Oklahoma, Texas, Arizona and Oregon (810); Missouri (490); vicinity of Washington, D. C. (300) and Martha's Vineyard (175). .	1775
A. E. Lomax, European plants	1686
A. H. Curtiss, plants of Florida	1025
Charles S. Sheldon, plants of New York collected chiefly by Professor Sheldon in Oswego and Tompkins counties	1020
C. F. Sonne, plants of California	400
H. E. Hasse, plants of California with some from Arkansas	445
J. H. Sandberg, plants of the northwestern states, including collections by J. H. Sandberg and J. B. Leiberg, and some Minnesota plants collected by Doctor Sandberg	380
Thomas Howell, plants of Washington and Oregon	355
A. B. Langlois, plants of Louisiana	345
Biltmore herbarium, southern states	280
S. B. Parish, plants of southern California	250
J. C. Alling, plants of Colorado (120) and Japan (114)	234
G. R. Vasey, plants from Florida, Texas, New Mexico, Michigan and the Pacific coast	141
W. N. Suksdorf, plants of Washington	120
Michener and Bioletti, plants of California	115
George W. Letterman, plants from Colorado, Texas and Pacific coast	110
E. Wilkinson, plants from the Santa Eulalia plains and hills, Chihuahua, Mexico	105
C. R. Orcutt, plants from southern California and northern Lower California	90
J. W. Chickering, jr, plants from the mountains of North Carolina and New England	85
John Donnell Smith, plants of Maryland and the southeastern states. .	76
H. H. Rusby, plants of Arizona	56
Miscellaneous collections: include plants from George B. Aiton (Idaho), Mrs M. E. P. Ames (California), C. F. Baker (Colorado), Baker and Earle (Alabama), H. C. Beardslee (Ohio and North Carolina), J. Blake (New England), F. Blanchard (Vermont), F. H. Burglehaus (Minnesota and Wisconsin), B. F. Bush (Missouri), B. P. Clark (New England), C. A. Davis (Michigan), H. M. Denslow (Illinois), L. S. Doud (New England), Dr K. O. Foltz (Ohio), C. D. Fretz (Pennsylvania), H. A. Green (New Jersey), A. A. Heller (Pennsylvania and North Carolina), Mr and Mrs G. H. Hicks (Colorado and Michigan), Mr and Mrs J. G. Lemmon, (California and Arizona), J. H. Oyster (Kansas), A. F. Rote (Wisconsin), C. C. Schmidt (Minnesota), H. A. Sheldon (California), Emma A. Shumway (Washington), A. H. Young (Indiana) and numerous other collectors	2744
Total number of specimens	14,403

The New York State specimens from Professor Sheldon's herbarium number 1020, of which the following should be recorded for their rarity or for the record of distribution which they establish.

Albany county

Amaranthus crispus (*Lesp. & Thev.*) *A. Braun*

Cayuga county

Moneses uniflora (*L.*) *A. Gray*

Pyrola chlorantha *Sw.*

Chemung county

Hydrangea arborescens *Linn.*

Magnolia acuminata *Linn.*

Polemonium reptans *Linn.*

Dutchess county

Adlumia fungosa (*Ait.*) *Greene*

Erie county

Clinopodium glabrum (*Nutt.*) *Kuntze*

Clintonia umbellulata (*Michx.*) *Torr.*

Corispermum hyssopifolium *Linn.*

Glycyrrhiza lepidota *Nutt.*

Hamilton county

Lobelia dortmanna *Linn.*

Herkimer county

Cytherea bulbosa (*L.*) *House*

Halenia deflexa (*Sm.*) *Griseb.*

Lewis county

Ophrys convallaroides (*Sw.*) *Wight*

Livingston county

Jeffersonia diphylla (*L.*) *Pers.*

Madison county

Phyllitis scolopendrium (*L.*) *Hoffm.*

Oneida county

Lepargyraea canadensis (*L.*) *Greene*

Onondaga county

Anticlea elegans (*Pursh*) *Rydb.*

Juncus gerardi *Loisel.*

Halerpestes cymbalaria (*Pursh*) *Greene*

Oswego county

Agalinis paupercula (*A. Gray*) *Britton*

Anemone cylindrica *A. Gray*

Andropogon furcatus *Muhl.*

Oswego county (continued)

Arethusa bulbosa *Linn.*
Ballota nigra *Linn.*
Bartonia virginica *(L.) B. S. P.*
Batrachium circinatum *(Sibth.) Rchb.*
Bidens beckii *Torrey*
Blephariglottis leucophaea *(A. Gray) Rydb.*
Botrychium silaifolium *Presl.*
" simplex *E. Hitchc.*
Clinopodium vulgare *Linn.*
Centaurium centaurium *(L.) Wight*
Dryopteris hexagonoptera *(Michx.) C. Chr.*
Eleocharis mutata *(L.) R. & S.*
" robbinsii *Oakes*
Equisetum littorale *Kuehl*
Eriophorum callitrix *Cham.*
Gaura parviflora *Dougl.*
Grindelia squarrosa *(Pursh) Dunal*
Heteranthera dubia *(Jacq.) MacM.*
Hieracium pilosella *Linn.*
Hyoscyamus niger *Linn.*
Isotria verticillata *(Willd.) Raf.*
Juncus balticus *Linn.*
" torreyi *Coville*
Lathyrus maritimus *(L.) Bigel.*
" myrtifolius *Muhl.*
Lecticula resupinata *(B. D. Greene) Barnhart*
Lychnis chalcedonica *Linn.*
" flos-cuculi *Linn.*
Lythrum alatum *Pursh*
" salicaria *Linn.*
Muhlenbergia willdenowii *Trin.*
Ophrys australis *(Lindl.) House*
Ophioglossum vulgatum *Linn.*
Potentilla recta *Linn.*
Ranunculus obtusiusculus *Raf.*
Razoumofskya pusilla *(Peck) Kuntze*
Rynchospora macrostachya *Torrey*
Scheuchzeria palustris *Linn.*
Utricularia gibba *Linn.*

Tompkins county

Batrachium trichophyllum *(Chaix) F. Schultz*
Aplectrum hyemale *(Muhl.) Torrey*
Disporum lanuginosum *(Michx.) Nichols*
Gymnocladus dioica *(L.) Koch*
Lathyrus ochroleucus *Hook.*
Lespedeza capitata *Michx.*
Parnassia caroliniana *Michx.*
Pinus resinosa *Ait.*
Pinguicula vulgaris *Linn.*
Primula mistassinica *Michx.*
Schmaltzia crenata *(Mill.) Greene*
Trollius laxus *Salisb.*

Wyoming county

Lysias orbiculata *(Pursh) Rydb.*

NEW OR INTERESTING SPECIES OF FUNGI

BY HOMER D. HOUSE

Aecidium lini Dearness & House, sp. nov.

Aecia caulicolous and amphigenous but mostly hypophyllous, in irregular groups or scattered, on discolored areas which are yellowish at first and finally reddish brown, small, 200 μ in diameter; peridium pale yellow, erose-truncate or lacerate and recurved, rising about 50 μ over the ruptured cuticle, cells rhomboidal, wider distally, overlapping, prominently verrucose, variable in size, averaging about 22 by 15 μ, wall 4–5 μ thick; aeciospores yellow, globose to ellipsoid, 18 to 22 by 16 μ, wall minutely verrucose, hardly 2 μ thick.

On stems and leaves of Linum virginianum. On herbarium specimens collected by Dr Charles H. Peck at Amagansett, Long Island, N. Y., July (the year not given). Type in the herbarium of the New York State Museum.

Ascochyta clematidina Thumen

North Greenbush, on living leaves of Clematis virginiana. H. D. House, *no. 247,* October 10, 1914.

Asteroma ribicolum E. & E.

North Greenbush, on living leaves of Ribes americana. H. D. House, *no. 248,* October 10, 1914. This and the last mentioned species are both new to the State flora.

Cercospora dubia (Riess) Wint.

Albany, on living leaves of Chenopodium album. H. D. House, October 20, 1914.

Cercospora teucrii E. & K.

Orient Point, Suffolk county, Long Island, on living leaves of Teucrium canadense. Roy Latham, August 14, 1911. New to the State flora.

Coniosporium lumulosum Sacc.

Tupper Lake, on dead wood of Pinus strobus. H. D. House, August 26, 1913. Cotype.

Cortinarius distans Peck

Oneida, Madison county. H. D. House, August 1914. The type locality is Greenbush, Rensselaer county, and the species has also been collected in the counties of Albany, Essex, Suffolk and Warren.

Curreya peckiana Sacc.

Tupper Lake, on dead stems of Nemopanthes mucronata. H. D. House, August 1913. Cotype.

Cytospora phomopsis Sacc.

Albany, on dead twigs of Sassafras variifolium. Cotype. Other twigs of the same collection showed the presence of the following additional species: Sphaeropsis sassafras E. & E. Sphaeropsis seriata Peck; Valsa subclypeata Cke. & Peck.

Dendrophoma phyllogena Sacc.

Eaton, Madison county, on living and languishing leaves of Chamaedaphne calyculata. H. D. House, August 30, 1913. Cotype.

Dothidella junci (Fr.) Sacc.

(Phyllachora junci *Fckl.*; Dothidea junci *Fr.*)

Albany, on dead and languishing stems of Juncus tenuis, H. D. House, August 1913. Also collected at Cedarville, Herkimer county, by Doctor Peck.

Harpographium magnum Sacc.

Near Albany, on dead stems of Prunus cuneata. H. D. House, July 1913. Cotype.

Hebeloma peckii nom. nov.

Hebeloma palustre Peck. N. Y. State Mus. Bul. 176, p. 20. 1915 (not Hebeloma palustre Peck. N. Y., State Mus. Bul. 25, p. 649. 1899).

Lactaria hygrophoroides B. & C.

(L. distans *Peck*)

Oneida, Madison county. H. D. House, August 1914.

Lactaria oculatus (Peck) Burlingham

(L. subdulcis var. oculatus *Peck*)

Thick leaf mold in deciduous woods near Oneida, Madison county. H. D. House, August 1914.

Lactaria obnubilis Lasch

A small species resembling L. subdulcis; pileus 1–2.5 cm broad, stem 2–5 cm long; the pileus convex to nearly plane with a

distinct darker colored umbo in the center which becomes very prominent and acute in drying. The lamellae are somewhat lutescent when young becoming brownish in older specimens.

Common in sunny sphagnum places in open woods near Oneida. H. D. House, August 1914. New to America.

Leptosphaeria houseana Sacc.

Albany, on dead stems of Thalictrum dioicum. H. D. House, April 1914. Cotype.

Macrophoma celtidicola Dearness & House, sp. nov.

Pycnidia depressed-globose, carbonous, scattered, seated on the cortex, erumpent through the cuticle, 180 μ broad; spores hyaline, 1–3 nucleate and grumous, obovate to oblong, rounded at the ends, 20–33 by 9–15 μ, on basidia of variable length, mostly 3–4 μ in thickness.

On dead twigs of Celtis occidentalis. Northampton, Fulton county. H. D. House, *no. 14.15a,* May 27, 1914. Type in the herbarium of the New York State Museum.

Marasmius elongatipes Peck

Oneida, Madison county. H. D. House, August 1914.

Micropeltis pitya Sacc.

Tupper Lake, on dead leaves of Abies balsamea. H. D. House, August 26, 1913. Cotype.

Peronospora effusa (Grev.) Rabenh.

Albany, on living leaves of Chenopodium album. H. D. House, October 20, 1914.

Phoma houseana Sacc.

Featherstone lake, Schenectady county, on dead stems of Vaccinium corymbosum. H. D. House, July 27, 1913. Cotype.

Phomopsis viticola Sacc.

Albany, on dead stems of Vitis aestivalis. H. D. House, March 1914. New to the State flora.

Phomopsis daturae (R. & F.) Sacc.

Albany, on dead steams of Datura stramonium. H. D. House, July 1913. New to the State flora.

Nothomyces nigricans Sacc.

Near Oneida, Madison county, on dead bark of Carpinus caroliniana. H. D. House, July 22, 1913. Cotype.

Phyllosticta baccharidis Dearness & House, sp. nov.

Spots flesh colored to pale ferruginous, subcircular, determined by the large veinlets, usually visible on both surfaces of the leaf and similar, but in some cases showing on the upper surface only, with a very distinct concolorous raised border, tending to be deciduous, 3–8 by 2–6 mm; pycnidia dark, amphigenous but more numerous on the upper surface of the spot, as many as thirty to a spot, round perforate but sometimes hysteriiform, 50–115 μ, mostly about 75 μ in diameter; spores hyaline, reniform, usually nucleate at each end, 4–6 by 3 μ.

On living leaves of Baccharis halimifolia Linn. Orient Point, Long Island. Roy Latham, August 14, 1911. Type in the herbarium of the New York State Museum.

Phyllosticta chenopodii Sacc.

Albany, on living leaves of Chenopodium album Linn. H. D. House, October 20, 1914. Apparently new to America as the specimens distributed in the North American Fungi, *no. 1158*, under this name are Septoria atriplicis.

Phyllosticta medeolae Dearness & House, sp. nov.

Spots reddish or gray-red areas beginning at the tips of the leaves and extending in some cases over half of the leaf; pycnidia black, sulcate, epiphyllous, scattered, about 100 μ in diameter; spores hyaline, sometimes guttulate, linear-oblong, 12–15 by 2–3 μ.

On living or languishing leaves of Medeola virginiana Linn. near Albany. H. D. House, *no. 14.137*, September 12, 1914.

Phyllosticta lantanoides Peck

Albany, on living leaves of Viburnum cassinoides Linn. H. D. House, September 12, 1914. Originally described from Caroga, on leaves of Viburnum alnifolium.

Phyllosticta nyssae Cooke

Karner, Albany county, on living leaves of Nyssa sylvatica Marsh. H. D. House, October 3, 1914. Apparently new to the State.

Phyllosticta oakesiae Dearness & House, sp. nov.

Spots colorless, translucent, surrounded by an indistinct border from which a reddish stain extends into the leaf tissues, one-half to 1 cm broad; pycnidia dark brown, epiphyllous but visible from beneath, 100–200 μ in diameter; spores hyaline, grumous or guttulate, elliptic to fusoid, 9–22 by 5–7 μ.

On languishing leaves of Uvularia (Oakesia) sessilifolia Linn. Karner, Albany county. H. D. House, *no. 14.218*, October 8, 1914. Type in the herbarium of the New York State Museum.

Phyllosticta orobella Sacc.

On languishing leaves of the Beach pea, Lathyrus maritimus (Linn.) Bigel. Orient Point, Long Island. Roy Latham, September 11, 1911. New to America. The spores are 2-guttulate and 7–11 by 3 μ.

Placosphaeria celtidis Dearness & House, sp. nov.

Stromata scattered, lenticel like, 1–2 by 1 mm, pycnidia 3–8 in a stroma, cortical, erumpent through the cuticle, carbonous, conical, 100–160 μ; spores issuing in cirrhi in the water, hyaline to amber, mostly 2-nucleate, 5–8 by 3–3.5 μ.

On dead twigs of Celtis occidentalis Linn. Saugerties. Dr Charles H. Peck, May. Type in the herbarium of the New York State Museum.

Puccinia tenuis (Schw.) Burrill, I.

(Aecidium tenue *Schw.*)

On leaves of Eupatorium ageratoides Linn. Near Hannibal, Oswego county. H. D. House, *no. 14.36*, June 27, 1914.

This species has also been collected in the Catskill mountains upon the same host by Dr Charles H. Peck, and near Ottawa, Canada, by Dr J. M. Macoun, *no. 156*, June 13, 1903.

Septoria breviuscula Sacc.

Eaton, Madison county, on languishing and dead leaves of Linnaea americana. H. D. House, August 30, 1913. Cotype.

Septoria lobeliae Pk. var. **lobeliae-inflatae** Sacc.

Albany, on living leaves of Lobelia inflata. H. D. House, July 1913. Cotype.

Sphaerella populnea Sacc.

Tupper Lake, on dead areas of living leaves of Populus balsamifera, associated upon the same leaves with Septoria populicola Peck. H. D. House, August 22, 1913. Cotype.

Sporodesmium pilulare Sacc.

Albany, on dead bark of Juniperus virginiana. H. D. House, July 1913. Cotype.

Rhabdospora clarkeana Sacc.

Sand lake, Rensselaer county, on dead stems of Aquilegia canadensis. H. D. House, July 4, 1913. Cotype. Named in honor of Dr J. M. Clarke, Director of the New York State Museum.

Ramularia obovata Fckl.

Karner, Albany county, on living leaves of Rumex obtusifolius. H. D. House, *no. 250,* October 8, 1914.

Russula variata Banning.

A common species in the sandy oak woods near Sylvan Beach, Oneida county, at the eastern end of Oneida lake. Collected there in August 1914, by H. D. House.

Venturia gaultheriae E. & E.

Karner, Albany county, on living leaves of Gaultheria procumbens. H. D. House, *no. 212,* October 8, 1914.

Macrophoma peckiana Dearness & House, sp. nov.

Pycnidia scattered, sometimes confluent, seated on the phloem fibers and raising the epidermis into oval, ruptured pustules 1 by ¾ mm; the short or flat black ostiola visible usually through a gray pulverulent layer of the disorganized cortex; spores hyaline, 10–12 by 4–4½ μ, wall 1 μ thick, on short basidia.

On dead twigs of Ceanothus americanus Linn. North Greenbush, Rensselaer county, collected by Dr C. H. Peck.

Thyridium ceanothi Dearness & House, sp. nov.

Perithecia carbonous, thickly and evenly scattered, globose, 160–360 μ, raising the epidermis through which shows the shining black stromatic shield; ostiola short punctiform; asci paraphysate, clavate,

stipitate, the stipe lengthening in water in extrème cases to 300 μ; p. sp. 75–90 by 6–12 μ; sporidia subbiseriate, triseptate, cells in some of the spores septate lengthwise (muriform); rounded and wider at the upper end, subacute at the lower end, smoky brown, 15–20 μ by 5–6 μ.

On dead twigs of Ceanothus americanus Linn. near Albany, N. Y., H. D. House, *no. 14.255* November 1, 1914. Type in the herbarium of New York State Museum.

Tyromyces spraguei (B. & C.) Murrill

Catskill, N. Y., on an oak stump. H. D. House, *no. 14.39*. August 19, 1914.

NEW OR NOTEWORTHY EXTRALIMITAL FUNGI

BY HOMER D. HOUSE

Cercospora argythamniae Dearness & House sp. nov.

Spots beginning as a yellowish green discoloration of the naturally purplish leaf, not determinate; the fruiting part with a definite yellowish or brownish border surrounded by a greenish rim, opaque when held up to the light, 2–4 mm in diameter and thickly dotted with the dark tubercular bases of the tufts of conidia; conidia arising from short or obsolete hyphae, pale brown when viewed with reflected light; amphigenous, obclavate, 15–40 μ by 2 μ above to 3 or even 3½ μ near the base, indistinctly 1–3 septate.

On Argythamnia mercurialina Muell. Caddo, Indian Territory (Oklahoma), June 22, 1891. Charles S. Sheldon.

Related to Cercospora crotonifoliae Cooke, which is epiphyllous and has cylindrical spores.

Gymnopilus subviridis Murrill, sp. nov.

Pileus convex to nearly plane, circular, 8–10 cm broad; surface dry, dull green with a bluish green bloom, becoming glabrous with age; margin very involute, undulate, not at all appendiculate; context greenish yellow with an agreeable odor; lamellae deeply emarginate, broad, inserted, distant, brownish green, uneven on the edges; spores broadly ovoid to subglobose, ferruginous, asperulate, about 5 by 3.5–4 μ; stipe long, slender, flexuous, largest at the middle, concolorous, staining brownish, fleshy-fibrous, greenish within, reaching 10–15 cm in length and 1 cm in thickness.

Type collected on a decayed fir stump at Olympia, Wash., November 27, 1914, by Miss M. McKenny (Herb. N. Y. State Museum). This is an interesting addition to the large number of species of this genus from the Pacific coast. It may readily be recognized by its green color. Two other species, G. subflavidus Murrill and G. viridans Murrill, become green spotted when handled, but they are entirely different from Miss McKenny's plant. For the benefit of those using Saccardo's nomenclature, this species is recombined as Flammula subviridis Murrill.

Cercospora absinthii (Peck) Sacc.

Marshfield, Oregon, on living leaves of Artemisia suksdorfii Piper. Dr W. Haydon, *no. 515*, September 9, 1914. The

fungus was found abundant and even in better condition than the type described by Doctor Peck as Helminthosporium absinthii, on Artemisia absinthium from North Elba, N. Y.

Cercospora namae Dearness & House, sp. nov.

Spots pale brown, immarginate; hyphae tufted, sooty-brown, short, distinctly visible under the hand lens, epiphyllous or at least mostly so; conida subcylindrical, hyaline, curved, 45–100 μ, mostly about 75 μ by 2.5 μ.

On Nama ovatum (Nutt.) Britton, (Hydrolea ovata Nutt.) Crebs, Indian Territory (Oklahoma). Charles S. Sheldon, August 21, 1891. Type in the herbarium of New York State Museum.

Cylindrosporium spigeliae Dearness & House, sp. nov.

Spots circular, grayish, 1–5 mm broad, with a distinct dark border about .5 mm wide; similar on both surfaces of the leaf; acervuli amphigenous, numerous, especially on the lower surface of the leaf, 50–90 μ, nearly concolorous but with somewhat darker margin; sporules hyaline, mostly straight, very obscurely if at all septate, but somewhat granular, 15–35 by 2 μ.

On living leaves of Spigelia anthelmia Linn. Elliott's Key, Florida. A. H. Curtiss, *no. 5454*, July 4, 1895. Type in herbarium of New York State Museum.

Laestadia galactina Dearness & House, sp. nov.

Perithecia dark brown, subcuticular, thickly and evenly scattered, mostly epiphyllous, globose, flattish but not depressed, 100–230 μ in diameter; asci aparaphysate, broadest near the middle, 8-spored, short-stipitate; spores 60–75 by 25 μ; sporidia hyaline, grumous to finely guttulate, 25–30 by 6–7 μ, rounded at the ends.

On dead and languishing leaves and petioles of Galax aphylla Linn. Biltmore, N. C. H. D. House. June 1913. Type in herbarium of New York State Museum.

Phyllosticta maurandiae Dearness & House, sp. nov.

Spots thin and circular, white with a raised border but no contiguous discoloration, scattered, small, 1–2 mm in diameter; pycnidia 0–21 on a spot, distinctly visible from both sides of the leaf, reddish, subglobose, 90–144 μ in diameter; spores hyaline, flat, oval, minute, 3.5–4 by 1 μ when measured on their edges, 3.5–4 by 2.75–3 μ when measured on their face, distinctly 2-nucleate.

On living leaves of Maurandia semperflorens Ort. Monte Alban, Oaxaca, Mexico. C. G. Pringle, *no. 4786.* August 14, 1894. Type in herbarium of New York State Museum.

Phyllosticta pachysandrae Dearness & House, sp. nov.

Spots ashen, becoming sordid brown, fruiting parts translucent, at first circular, 2–5 mm broad and later becoming confluent and breaking down the leaf in large areas along the margin; pycnidia epiphyllous, globose-conic, perforate at summit, brown, 90–110 μ; spores minute, very numerous, hyalin, oblong, 4.5–6 by 1 μ.

On living leaves of Pachysandra procumbens Michx. cultivated in the Biltmore Nurseries at Biltmore, N. C. H. D. House, June, 1913. Type in herbarium of New York State Museum.

Phyllosticta rhexiae Dearness & House, sp. nov.

Spots reddish brown, 1.5–2 mm in diameter, with a white center bearing a single pycnidium, similar on both surfaces of the leaf; pycnidia solitary in the white center of the spot, epiphyllous, brown, minute, 40–50 μ in diameter; spores minute, subhyaline, oblong or nearly so, 3 by 1 μ.

On living and languishing leaves of Rhexia ciliosa Michx. Jacksonville, Fla. A. H. Curtiss, June 24, 1896.

Septoria darlingtoniae Dearness & House, sp. nov.

Spots forming grayish, irregular areas from 1 mm to 1.5 cm broad; cuticle becoming more or less detached and where quite separate presenting pale or whitish spots, upon which and around which the pycnidia are numerous; pycnidia brown, thin, often open at the top, 80–140 μ; sporules hyaline, continuous or 1–3-septate, somewhat stouter at one end and marked in most cases by apparently flattened sections, 20–64 by 2.5–3 μ.

On living and languishing leaves of Darlingtonia californica Torrey. Marshfield, Ore. H. D. House, August, 1912. Type in herbarium of New York State Museum.

Septoria erythraeae Dearness & House, sp. nov.

Spots ill defined, somewhat pallid areas over the whole leaf and along the stems, the punctation of the numerous pycnidia rendering the affected area more obvious on most leaves than the discoloration; pycnidia numerous, scattered, visible from both surfaces of the leaf, more numerous above than below, brown, subconic, small, 30–75 μ in diameter, mostly between 50 and 60 μ; sporules straight, continuous, hyaline, 15–30 μ, but mostly about 25 by 1–1.5 μ.

On leaves and petioles of Erythraea macrantha H. & A. on mountains near Chapala, Jalisco, Mexico. C. G. Pringle, *no. 2422*, December 16, 1889. Type in herbarium of New York State Museum.

Septoria tinctoria Dearness & House, sp. nov.

Spots brownish-red, circular, mostly about 1 cm in diameter, similar but paler beneath, having a white central area 2–4 mm in diameter with a distinct, sharply-raised, black border; pycnidia strictly epiphyllous, 1–12, scattered on the white central area, semiimmersed, black with a paler center, 80–100 μ; sporules hyaline, curved, cylindric, 2–4-septate, 25–48 by 2.5–3 μ.

On living leaves of Symplocos tinctoria L'Her. Prescott, Ark. G. W. Letterman, August, 1892. Type in herbarium of New York State Museum.

Septoria stigma B. & C., on this host, has short sporules 15 μ; and Septoria symploci Ell. & Mart. has hypophyllous perithecia and cylindric-clavate sporules.

Phyllosticta raui (Peck) Dearness & House

Sphaeropsis raui Peck. Bot. Gaz. 3: 34. 1878. Phoma raui Sacc. Syll. 3: 143. 1884. Macrophoma raui Berl. & Vogl. in Atti Soc. Veneto-Trentina p. 181. 1886.

Examination of the type material collected in Colorado on Artemisia scopulorum, by Brandegee, and communicated to Doctor Peck by E. A. Rau, shows that it properly belongs in the genus Phyllosticta.

Peridermium cerebrum Peck

An interesting form of this species occurs upon Pinus chihuahuana in Arizona, and causing an abortion of the cones as shown in the accompanying plate. The specimen from which this illustration was taken was collected near Canille, Ariz., by Mr William T. Doherty, July 12, 1914.

Specimens of Peridermium carebrum hitherto collected in this country have been caulicolous, producing enlargements of woody stems. This appears to be, so far as I can learn, the first collection of the species on cones. It will doubtless prove to be a different species when its telial stage (some species of Cronartium) becomes known. The dehiscence of the aecia is quite charactertistic,

Peridermium cerebrum Peck, causing abortion of cone on *Pinus chihuahuana*

resembling Peridermium filamentosum, but lacking the usual filaments which run up through the mass of spores in that species. In P. cerebrum the upper part of the peridia usually flakes off in scales, which is quite unlike the way this specimen appears to behave, the peridia of which stand up prominently and are beautifully fringed. The spores exceed in length the measurements given for either of these species.

Melanopsamma waghornei House, nom. nov.

Melanopsamma borealis E. & E. Proc. Phil. Acad. Nat. Sci. 1893. p. 445. Sacc. Syll. XL: 305. Type collected in Newfoundland by Waghorne.

The host plant is not given, but the specimen in the herbarium of the New York State Museum, a cotype, appears to be upon Populus. The name proposed for it by Ellis and Everhart is antedated by Melanopsamma borealis (Karst.) Sacc. Mich. 1: 347; Sacc. Syll. 1: 578.

Ramularia delphinii Dearness & House, n. sp.

Spots arid, circular to oblong, extending between the veins 3 to 5 mm, bounded by a raised dark brown border, paler above but otherwise alike on both sides of the leaf: tufts of fertile hyphae prominent, hypophyllous, 15–30 by 2½–3 μ, bearing continuous conidia 15–33 by 4–5 μ.

On leaves of Delphinium scopulorum Gray. Collected by Charles S. Sheldon, El Paso county, Colorado. August 10, 1892. Type in herbarium of New York State Museum.

WESTERN PLANTS INTRODUCED AT ROCHESTER

BY HOMER D. HOUSE

Among some specimens received for identification from Prof. M. S. Baxter, of Rochester, was found a grass which was determined as Stipa comata Trin. & Rupr., known in the west as porcupine or blow-out grass. Its natural range is from Iowa to Texas, California and Yukon. It is an interesting addition to the already long list of western plants which have become established in the vicinity of the Cobb's hill reservoir at Rochester and collected there by Mr Baxter and by Miss Beckwith.

With the cutting away of the forests of the east and the gradual drying up of a large portion of the soil, the tide of weed migration from European countries has been met by a countermigration of western species, which are largely adapted to dry situations, into the fields and waste places of the eastern states.

Following the construction of the Cobb's hill reservoir at Rochester, a rather notable establishment of western species took place. This may be partly explained by the use of western hay or grain for the animals used in the work, if such was the case. In the absence of evidence regarding the means by which the seeds of these western species reached Cobb's hill, and the fact that few of them have been reported from other eastern localities would seem to indicate that the seeds reached there in either hay or grain.

During the summers of 1910 to 1914, a large number of these western emigrants were collected there by Prof. M. S. Baxter and by Miss Florence Beckwith. The list of them which follows includes only those deposited in the State herbarium.

Artemisia carruthi *Wood*
" biennis *Willd.*
" dracunculoides *Pursh*
" frigida *Willd.*
" glauca *Pall.*
" trifida *Nutt.*
Anogra albicaulis (*Pursh*) *Britton*
Allionia hirsuta *Pursh*
Aster multifolius *Ait.*
Chaenactis stevioides *Hook. & Arn.*
Bidens tenuisecta *A. Gray*
Chrysothamnus pinifolius *Greene*
Boebera papposa (*Vent.*) *Rydb.*
(Drysodia papposa (*Vent.*) *Hitchc.*)
Grindelia squarrosa (*Pursh*) *Dunal*
" squarrosa nuda *A. Gray*
Gaura coccinea *Pursh*
Gymnolomia multiflora (*Nutt.*) *Benth. & Hook.*
Helianthus petiolaris *Nutt.*
Lappula echinata *Gilibert*
Lygodesmia exigua *A. Gray*
Machaeranthera pulverulenta (*Nutt.*) *Greene*
" tanacetifolia (*H. B. K.*) *Nees*
Monolepis nuttalliana (*R. & S.*) *Greene*
Salsola pestifer *A. Nelson*
Sideranthus gracilis (*Nutt.*) *Rydb.*
Verbena bracteosa *Michx.*
Stipa comata *Trin. & Rupr.*

Most of these species have been observed for from two to four years, and it is an interesting conjecture as to whether they will become permanent members of our flora or soon disappear. Some of them are already well established in many localities, such as Salsola pestifer, Verbena bracteosa and Grandelia squarrosa, which are fast becoming obnoxious weeds in many places.

NOTES UPON LOCAL FLORAS

BY HOMER D. HOUSE

1 FULTON COUNTY

Orontium aquaticum Linn.

Collected near Broadalbin in June 1884, by J. D. Greenslete. The specimen is preserved in the State herbarium and Messrs A. Olsson and C. P. Alexander, who have collected extensively in this section within the past few years, have failed to rediscover this species. The Fulton county record of this species is interesting because the species is credited in this State usually only to the southern counties, the specimens in the State herbarium being from southern Chenango county, Sullivan, Orange, Richmond and Suffolk counties.

Trillium cernuum Linn.

Rich, moist soil in thickets and thin woods, near Northampton. H. D. House, May 27, 1914. *No. 5424.*

Viola lanceolata Linn.

Moist meadows, near Northampton. H. D. House, May 27, 1914. *No. 5422.*

Viola primulaefolia Linn.

Moist meadows, near Northampton, growing with Viola lanceolata. H. D. House, May 27, 1914. *No. 5421.*

Viola septentrionalis Greene

Open wood and roadsides, near Northampton. H. D. House, May 27, 1914. *No. 5412.*

Viola fimbriatula x septentrionalis Brainerd

Roadsides near Northampton. H. D. House, May 27, 1914. *No. 5415.*

2 HERKIMER COUNTY

Lysimachia vulgaris Linn.

Common and thoroughly naturalized along the banks of West Canada creek from Herkimer up to Poland. Collected at Newport, H. D. House, July 23, 1914. *No. 5688.* The golden or yellow loosestrife seems to have been early introduced in this region as an

ornamental plant and has become naturalized everywhere in the woods and thickets along West Canada creek. Also collected at Herkimer by Dr J. V. Haberer.

Serapias helleborine Linn.

Mohawk river flats near Little Falls. Mrs Loomis Burrell, July 23, 1914. Commonly supposed to be an introduced species from Europe, where it is common. In America it is now known from a number of localities in New York State ranging from Little Falls to Rochester. Its appearance in all these localities is that of a native plant and in the absence of any evidence as to its nonindigenous character should be regarded as a native species.

Cassia marilandica Linn.

Meadows and stream banks, near Newport. H. D. House, July 23, 1914. *No. 5686.*

3 MADISON COUNTY

Geum meyerianum Rydberg

(Geum agrimonioides *C. Meyer,* 1846, not Pursh, 1814)

Related to Geum canandense, but the basal leaves and lower stem leaves are pinnatifid and the stem is more hirsute. These characters are sometimes found in Geum hirsutum Muhl., but the petals in G. meyerianum are white and longer than the sepals, while in G. hirsutum they are pale yellow and much shorter.

Doctor Rydberg reports the species from Fleischmann, Delaware county, and from Orange county, and from Oneida (H. D. House, 1903) Madison county, in addition to which there is a specimen in the State herbarium from Troy, collected by E. C. Howe.

Apargia hispida (Linn.) Willd.

Waste grounds near Oneida. H. D. House, June 9, 1914. *No. 5556.*

Carex abacta Bailey

(C. rostrata *Michx.,* C. michauxiana *Boeckl.*)

Borders of the sphagnum bog known as " Fiddler's green," Pecksport. H. D. House, July 27, 1914. *No. 5761.*

Castanea dentata Borkh

Sandy loam soil in mixed woods, near Kenwood, 2 miles south of Oneida. H. D. House, July 21, 1914. *No. 5685.* The chestnut is not a common tree in central New York as most of the soils either contain too much lime or are derived directly from underlying limestone, a condition which seems to be inimical to the growth of the chestnut. So far as I know this is the only locality for the chestnut in Madison county, although it has been successfully planted in a number of places.

Lonicera oblongifolia (Goldie) Hooker

Peterboro, in a sphagnum bog. H. D. House, June 11, 1914. *No. 5547.*

Smilacina trifolia Linn.

Arbor Vitae swamps around the edge of sphagnum bogs, Peterboro. H. D. House, June 11, 1914. *No. 5550.* Pecksport, June 10, 1914. *No. 5514.*

Kalmia polifolia Wang.

Sphagnum bog, Pecksport. H. D. House, June 10, 1914. *No. 5525.*

Lonicera hirsuta Eaton

Dry thickets along edge of woods near Pecksport. H. D. House, July 27, 1914. *No. 5736.*

Galium labradoricum Wiegand

Sphagnum bogs, Pecksport. H. D. House, June 10, 1914. *No. 5517.* Peterboro, June 11, 1914. *No. 5549.*

Linnaea borealis Linn.

Woods near Pecksport in open places amongst mixed stands of hemlock and hardwoods. H. D. House, June 10, 1914. *No. 5531.* This species, known commonly as the "twin-flower," is fairly abundant throughout the mountainous parts of the State but is scarce or local elsewhere.

Carex pseudo-cyperus Linn.

Swamps near Pecksport. H. D. House, July 27, 1914. *No. 5742.*

Eriophorum callitrix Cham.

Very abundant on the surface of the sphagnum bog known as "Fiddler's green," Pecksport. H. D. House, June 10, 1914. *No. 5524.*

Phyllitis scolopendrium (L.) Newm.

(Scolopendrium vulgare *Sm.*)

In the rich humus, covering the talus of limestone cliffs at Chittenango Falls, under the dense shade of mixed hardwoods and hemlock. H. D. House, June 9, 1914. *No. 5509.*

The species was first discovered at Chittenango Falls by Mr William Cooper about 1830 and remained until 1857 the only American station definitely known, although it was earlier discovered at Geddes, Onondaga county, by Frederick Pursh, on July 20, 1807. For many years it was supposed that Pursh's locality was the Chittenango Falls station until it was rediscovered at the Geddes locality in 1879 by members of the Syracuse Botanical Club. In July 1898, the fern was discovered at Perryville, Madison county, by Miss Murray Ledyard of Cazenovia.

A full and interesting history of the occurrence of this rare fern in America is given by Mr William R. Maxon in Fernwort Papers, pages 30–46, December 20, 1909.

Batrachium trichophyllum (Chaix.) F. Schultz

(Ranunculus aquatilis var. trichophyllum (*Chaix.*) A. Gray

In slow streams, near Pecksport. H. D. House, July 27, 1914. *No. 5737.*

Azalea nudiflora Linn.

In open woods along the edge of a swamp near Pecksport. H. D. House, June 10, 1914. *No. 5523.*

Coronilla varia Linn.

Common along roadsides between Clockville and Peterboro. A native of Europe and frequently introduced and escaped either by cultivation or by introduction with grain and grass seed. Commonly known as axseed or axwort.

Viola incognita Brainerd

Rich, rocky woodlands, Chittenango Falls. H. D. House, June 9, 1914. *No. 5507.* This long-neglected violet proves to be one of

the commonest species of the genus in rich, moist woodlands, while Viola pallens (V. blanda Auth. not Ait.) with which it was long associated, is confined to sphagnum or mossy swamps.

Viola incognita var. **forbsii** Brainerd

Rich, moist woods, near Pecksport. H. D. House, June 10, 1914. *No. 5520.*

Rhodiola rosea Linn.

(Sedum roseum *Scop.*, Sedum rhodiola *DC.*)

Limestone cliffs at Chittenango Falls. H. D. House, July 26, 1914. *No. 5730.* First collected here several years ago and determined by Dr B. L. Robinson. The colony of plants consists of less than a dozen individuals, tightly wedged in an almost inaccessible crevice of the cliff. The range of the species is chiefly subarctic, from Labrador to Maine and Vermont and northern Europe. The State herbarium contains in addition a specimen collected on the cliffs of the west side of Seneca lake, many years ago by Samuel H. Wright M. D., and which has seemingly passed unquestioned as Sedum telephioides Michx., which it was labeled. The fruit character, however, consisting of four erect folicles with their tips barely spreading, serves to distinguish it readily from Sedum telephioides, which possesses usually five distinctly spreading folicles. According to the books Rhodiola rosea has also been collected on the cliffs of the Delaware river in eastern Pennsylvania.

4 ONEIDA COUNTY

Agrostis maritima Lam.

(A. coarctata *Ehrh.*, A. alba maritima *G. F. W. Mey.*)

In dry sand along the shore of Oneida lake, Sylvan Beach. Dr J. V. Haberer, *no. 1724,* July 1900. H. D. House, *no. 5615,* June 1914.

Azalea nudiflora Linn.

Sylvan Beach. H. D. House, *no. 5486.* June 8, 1914.

Blephariglottis ciliaris (L.) Rydb.

Sylvan Beach. H. D. House, *no. 5721.* July 24, 1914. The golden-fringed orchid, as this species is commonly known, is rather rare north of the coastal region of the State. It has been collected at North Manlius, Onondaga county, by Dr Hermann Wibbe in 1871,

at Irondequoit, Monroe county, by Rev. L. Holzer in 1867, and is fairly abundant on the pine plains west of Albany, where it was first collected about 1830 by Lewis C. Beck and more recently by Dr Charles H. Peck.

Carex swanii (Fernald) Mackenzie

Sylvan Beach. H. D. House, *no. 5699.* July 24, 1914.

Cenchrus carolinianus Walter

Sandy fields near Fish Creek station, where perhaps introduced. H. D. House, *no. 5832.* August 10, 1914.

Chamaesyce humistrata (Engelm.) Small

Sylvan Beach, in sandy soil. H. D. House, *no. 5641.* July 20, 1914.

Ibidium gracile (Bigel.) House

Common in sandy fields and open woods near Sylvan Beach. H. D. House, *no. 5620.* July 20, 1914.

Lathyrus maritimus (Linn.) Bigelow

Common in sandy grassy places and open sandy woods along the shore of Oneida lake, north of Sylvan Beach. H. D. House, *no. 5608.* July 20, 1914.

Leptasea aizoides (Linn.) Haw.

Cliffs of Fish creek above Taberg, growing with Primula mistassinica, Lobelia kalmii, Parnassia caroliniana and many other moist clift-loving species. H. D. House, *no. 5653.* July 21, 1914.

Lythrium salicaria Linn.

Wet, marshy places along the shore of Oneida lake, near Sylvan Beach. H. D. House, *no. 5613.* July 20, 1914.

Nymphaea rubrodisca (Morong) Greene

Waters of Fish creek near Sylvan Beach. H. D. House, *no. 5634.* July 20, 1914. Said to be a hybrid between N. variegata and N. microphylla, which is quite possible since it is intermediate in appearance and both of the species mentioned are common here.

Its hybrid origin appears to be the more certain since it is not found in places where N. microphylla is absent. This is true of ponds like those in the swamps known as Fiddler's green, near Pecksport, Madison county, where N. variegata is very abundant.

Nyssa sylvatica Marsh.

Low woods near Sylvan Beach. H. D. House, *no. 5457.* June 5, 1914.

Parnassia caroliniana Michx.

Mossy dripping rocks and cliffs along Fish creek above Taberg. H. D. House, *no. 5663.* July 21, 1914.

Plantago aristata Michx.

Sandy roadsides near Sylvan Beach, probably introduced. H. D. House, *no. 5624.* July 20, 1914.

Polygala viridescens Linn.

Sandy fields and roadsides near Sylvan Beach. H. D. House, *no. 5621.* July 20, 1914.

Populus deltoides Marsh.

Low woods about the eastern end of Oneida lake. H. D. House, *no. 5473.* June 5, 1914.

Rhexia virginica Linn.

Very abundant in a low, sandy meadow north of Sylvan Beach. H. D. House, *no. 5611,* July 20, 1914. The species was reported from this locality many years ago by Kneiskern, and it also occurs westward along the northern shore of Oneida lake to Constantia, where it was found by Dr George Vasey. These are the only localities in the State north of the coastal region which are known for the species.

Silene dichotoma Ehrh.

Sandy fields near Fish Creek station and introduced. H. D. House, *no. 5831,* August 10, 1914.

Verbascum lychnitis Linn.

Sylvan Beach. H. D. House, *no. 5616,* July 20, 1914. It is interesting to note what J. A. Paine, jr (Flora of Oneida County, 1865) says of this species.

" Barren sandy fields and copses on a ridge at the head of Oneida lake, parallel with the shore, beyond which are swamps. It is most abundant around the mouth of Fish creek. Here are the ruins of an old fort, which may account for the introduction of the plant. Two hybrids between this species and V. thapsus, one resembling the latter with a simple stem and yellow flowers, and the other the former with paniculate branches and white corollas, were observed by Kneiskern."

The ruins of the fort mentioned have disappeared, but the " white mullin " is still abundant there as are the hybrids mentioned, which may be described as follows:

Verbascum lychnitis x thapsus, hyb. nov

Flowers pale yellow in long terminal spikes or loosely panicled; leaves somewhat decurrent, stems angled; the two lower filaments of the flowers beardless like V. thapsus, the three upper ones clothed with whitish wool; flowers about 1.5 cm broad.

5 ONONDAGA COUNTY

Mariscus mariscoides (Muhl.) Kuntze

Salt marshes, foot of Onondaga lake. Miss Mary Oliva Rust, September 19, 1883.

Ruppia maritima L. var. **onondagensis** Fernald & Wiegand

Onondaga lake, J. A. Paine, jr, 1864 (in herbarium of New York State Museum), Dr J. V. Haberer, September 1878. The specimens collected by Paine are quite likely duplicates of the type of the variety onondagensis, described by Fernald and Wiegand in Rhodora 16: 126. 1914. The differences between the plants collected by Paine and Haberer and one from Coney island (T. F. Allen, 1864) are so slight, that the plants from Onondaga lake can scarcely be regarded as a distinct variety.

Plantago major Linn. var. **intermedia** (Gilbert) Des.

Salt marshes near Onondaga lake. C. S. Sheldon, July 22, 1880. Also collected at Saranac lake and at Eastport, Long Island, by Peck.

Carex eburnea Boott

Limestone ledges and open places. Green lake near Kirkville. H. D. House, June 6, 1914. *No. 5478.*

6 OSWEGO COUNTY

Carex incomperta Bicknell

(Carex sterilis *Willd.*, in part)

In sphagnum under the shade of tamarack and spruce, "Lily marsh," H. D. House, July 30, 1914. *No. 5797.* New to State herbarium.

Carex howei Mackenzie

(Carex interior capillacea *Bailey*, Carex scirpoides capillacea *Fernald*, Carex delicatula *Fernald*)

Wet shady soil, shore of Lake Ontario, 3 miles east of Oswego. H. D. House, July 29, 1914. *No. 5770.*

Carex exilis Dewey

Sphagnum bog bordering Mud lake, Hannibal. H. D. House, June 27, 1914. *No. 5599.*

Carex limosa Linn.

Sphagnum bog bordering Mud lake, Hannibal. H. D. House, June 27, 1914. *No. 5595.* "Lily Marsh," July 30, 1914. *No. 5796.*

Agalinis paupercula (A. Gray) Britton

(Gerardia paupercula *Britton*)

Mud lake, Hannibal, in the sphagnum bog bordering the lake. C. S. Sheldon.

Utricularia intermedia Hayne

Mud lake, Hannibal. H. D. House, June 27, 1914. *No. 5593.*

Lonicera oblongifolia (Goldie) Hooker

Mud lake, Hannibal. H. D. House, June 27, 1914. *No. 5583.*

Triglochin maritima Linn.

Mud lake, Hannibal. H. D. House, June 27, 1914. *No. 5585.*

Eriophorum alpinum Linn.

Very abundant in the sphagnum bog bordering Mud lake, Hannibal. H. D. House, June 27, 1914. *No. 5591.*

Lepargyraea canadensis (Linn.) Greene

In thickets and open woods on the high bluffs facing Lake Ontario, west of Oswego. H. D. House, June 26, 1914. *No. 5558.*

Lychnis flos-cuculi Linn.

Sheldon's grove, Oswego. H. D. House, June 26, 1914. *No. 5560.*

Hieracium pratense Tausch.

Sheldon's grove, Oswego. H. D. House, June 26, 1914. *No. 5562.* This new addition to the flora of the State is a native of Europe and has already been noted at several places from eastern Quebec to southern New England. It bears a close resemblance to Hieracium florintinum All. but differs in having an elongated, slender rootstock and numerous leafy stolons, while Hieracium florentinum possesses a short, stout rootstock and is not stoloniferous. This new arrival of the "hawk-weeds" is already abundant at Sheldon's grove and is spreading vigorously.

Mariscus mariscoides (Muhl.) Kuntze

(Cladium mariscoides *Torrey*)

Shores of Panther lake, H. D. House, August 4, 1914. *No. 5824.* The distribution of this species in central New York is decidedly local, and about the borders of most of the lakes where one would expect to find the species it is entirely lacking. It has been collected at Litchfield, Herkimer county, by Doctor Peck.

Lysias macrophylla (Goldie) House

(Muhlenbergia 1: 127. 1906)

(Habenaria macrophylla *Goldie*)

Moist woods under the shade of pine and hemlock. Panther lake. H. D. House, August 4, 1914. *No. 5819.* This species differs from Lysias orbiculata, chiefly in the greater length of the spur of the flower.

Lycopodium annotinum Linn.

Moist woods under the shade of pine and hemlock. Panther lake. H. D. House, August 4, 1914, *No. 5826.* This locality constitutes one of the few known stations of the State for this species outside of the Adirondack and Catskill mountain regions.

Isotria verticillata (Willd.) Rafinesque

In deep shade under spruce and tamarack bordering "Lily marsh," H. D. House, July 30, 1914, *No. 5804*.

Blephariglottis blephariglottis (Willd.) Rydberg

(Blephariglottis blephariglottis (*Willd.*) *Rydberg*)

Abundant in the open, sunny portions of the sphagnum bog known as "Lily marsh." H. D. House, July 30, 1914, *No. 5792*.

Populus deltoides Marshall

Shore of Lake Ontario, east of Oswego. H. D. House, July 29, 1914, *No. 5778*.

Populus candicans Aiton

Shore of Lake Ontario, east of Oswego. H. D. House, July 29, 1914, *No. 5779*. Large trees growing with Populus deltoides, Populus balsamifera and other hardwoods, appearing native but perhaps adventive. The origin of this species, which is common in cultivation and freely escaping, known popularly as the balm of Gilead, seems never to have been definitely settled, although it has been suggested that it has an Asiatic origin. It was described in 1829 by Desfontaines as Populus ontariensis, and there are numerous references to the species in literature which seems to indicate that the species is native to the Great Lakes region and westward to Montana, where the writer has seen it growing on the shores of Lake McDonald.

Nyssa sylvatica Marshall

Swamps and low woods along the shore of Lake Ontario, about 3 miles east of Oswego. H. D. House, July 29, 1914, *No. 5768*. Abundant and of large size. This is the most northerly locality for the species known in New York State.

Ranunculus obtusiusculus Rafinesque

(Ranunculus alismaefolius *A. Gray*)

(Ranunculus ambigens *S. Wats.*)

In a small marsh about 3 miles east of Oswego. H. D. House, July 30, 1914, *No. 5807*.

Stomoisia cornuta (Michx.) Rafinesque

(Utricularia cornuta *Michx.*)

Very abundant in the open sunny portions of the sphagnum bog known as "Lily marsh." H. D. House, July 30, 1914, *No. 5786.*

Potentilla recta Linn.

Fields and waste places about Oswego. H. D. House, July 29, 1914, *No. 5785.*

Centaurium centaurium (Linn.) W. F. Wight

(Erythraea centaurium *Persoon*)

Roadsides and embankments about Oswego. H. D. House, July 29, 1914, *No. 5771.* Introduced and naturalized about the port of Oswego many years ago (specimen in the Beck herbarium dated August 10, 1830) and spreading in various directions. It has been observed as far south as Fulton and Syracuse and several miles eastward. Possessing none of the obnoxious features of a weed, it forms an interesting addition to our emigrant flora. For many years Oswego was the only known American station for this species, but it is now known from many places throughout the eastern states.

Lathyrus myrtifolius Muhlenberg

Moist thickets near the shore of Lake Ontario, west of Oswego. H. D. House, July 29, 1914, *No. 5783.*

Drosera intermedia Hayne

Very abundant in the open, sunny portions of the sphagnum bog known as "Lily marsh." H. D. House, July 30, 1914, *No. 5788.*

Rhynchospora macrostachya Torrey

Mud lake, Hannibal. Dr Herman Wibbe, September 1877. This specimen occurs in the Sheldon herbarium recently donated to the State Museum, and constitutes an outlying station for a species fairly abundant in the coastal plain region farther south. The only other specimens in the State herbarium from this State were collected at Wading River and Smithtown, Long Island.

NEW YORK SPECIES OF MARASMIUS

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Many species of Marasmius occupy a unique position as the xerophytes among the Agarics. They play an important rôle in the formation of humus, since among the higher fungi they are the first to attack and begin the decomposition of leaves, twigs etc. which fall into situations not moist enough to permit the growth of ordinary humus forming fungi. For example, Marasmius androsaceous (L.) Fr. grows upon dead pine needles upon ledges of rock and other exposed situations where the rain water runs off or dries up quickly, and Marasmius minutus Peck may be found upon dead leaves before they have fallen to the ground. The ability of the dried plants to revive readily when moistened makes it possible for them to take advantage of every moist period, no matter how short, to continue their growth.

Although many species of Marasmius are among the first fungi to begin the decay of plant tissues, very few of them are parasitic, and therefore they play but a small part in causing plant disease. In the tropics a few species as M. sacchari Wakker, and M. plicatus Wakker are known to cause serious rootrot in sugar cane. M. caryophylleus (Schaeff.) Schröt., the common fairy ring mushroom, has been shown to be a weak parasite upon roots and underground stems of grasses. The grass is at first stimulated to produce a more vigorous growth with a darker green color than usual. It may then die thus making it possible, even when the fungus is not visible, to detect its presence in lawns by the bare spots where it has killed the grass.

M. caryophylleus is practically the only species of Marasmius which is commonly used as a food. This species is highly esteemed by many people and is considered equal to any other mushroom for the table. M. alliatus (Schaeff.) Schröt., which has the odor and taste of onions, is said to be used in European countries to flavor other dishes. Several species have a bitter or acrid taste and are considered as poisonous. Some have both a disagreeable odor and taste.

Seventy-one species of Marasmius are known in temperate North America. Fifty-five of these have been described or reported from New York State, the majority of them by the illustrious former State Botanist Dr Charles H. Peck. Seventeen species are considered as common to both Europe and North America. Further

study will probably show that more of our American species are common to both continents. In a few instances where there has been confusion of names, American names have been retained for species which are apparently found in Europe also.

A more complete account of the North American species of Marasmius is to be found in vol. 9, pt. 4 of the North American Flora (1915).

A few species, as M. nigripes (Schw.) Fr. and M. foetidus (Sow.) Fr., are somewhat gelatinous when they are fresh and moist. They have therefore sometimes been considered as belonging to the genus Heliomyces. Since the species of Heliomyces are practically confined to the tropics and the above-named species resemble species of Marasmius more than they resemble the typical species of Heliomyces, they are here retained in the genus Marasmius.

The Fresian system of classification has not been found to be entirely practicable for our species. The general arrangement of the species from the large Collybia-like forms down to the small forms with the tough bristlelike stipe is very similar to the usual arrangement. Rather more attention, however, has been paid to the stipe with respect to its surface, whether rough and hairy or smooth and shining, than to the character of the pileus. At its best any system of classification is more or less artificial. The present arrangement will serve its purpose if it helps the student to identify the species of Marasmius as he finds them.

Maramius Fries

Gen. Hymen 9. 1836

Pileus tough, fleshy to membranous, either continuous with the stipe or of a different texture, surface often sulcate or striate, not zonate, dry, glabrous or rarely minutely tomentose or pruinose, margin involute or straight in young plants, becoming broadly convex, plane or uplifted with the disk elevated or depressed, rarely umbilicate; context more or less tough and dry, sometimes soft fleshy but not brittle, dry plants reviving when moistened; lamellae dry, rather thin, often of unequal length, often interveined, but seldom forking, developing slowly, rarely remaining very narrow, almost veinlike; color varying from white to yellow, reddish or purplish, often changing in dry plants; stipe central, seldom fleshy, tough, horny, stuffed or hollow, often slender or capillary, sometimes solid, glabrous or more or less tomentose, hairy, or strigose;

spores white, smooth (angular in M. nigripes) (Schw.) Fr. elliptic, rarely globose when mature, usually more or less obliquely apiculate, maturing slowly and unequally so that it is often difficult to find mature spores in dried plants. The plants usually grow upon vegetable matter, grass, leaves, twigs, bark, wood etc., but very seldom upon soil.

Key to Species

I Pileus fleshy or subfleshy, 1 cm or more broad; stipe more or less tomentose or hairy, at least below; lamellae free or adnexed. Some large plants with nearly smooth stipe are placed in this section.

- Pileus white .... 34 M. phyllophilus
- Pileus not white, sometimes pallid in dried plants
  - Plants large, pileus 2 cm or more broad
    - Lamellae crowded
      - Plants with odor and taste strong of onions
        - Spores small .... 1 M. polyphyllus
        - Spores 12–14 μ long .... 2 M. prasiosmus
      - Plants with neither odor nor taste of onions
        - Stipe smooth above .... 6 M. fasciatus
        - Stipe more or less tomentose throughout
          - Lamellae free, remote; stipe enlarged at the apex .... 3 M. confluens
          - Lamellae adnexed; stipe not enlarged at the apex
            - Stipe long and twisted; pileus usually pallescent .... 4 M. archiropus
            - Stipe not long and twisted; pileus brown .... 5 M. multifolius
    - Lamellae not crowded
      - Taste strong and acrid; lamellae usually becoming reddish
        - Pileus purple .... 9 M. iocephalus
        - Pileus not purple
          - Lamellae broad .... 7 M. peronatus
          - Lamellae narrow
            - Stipe long .... 8 M. subnudus
            - Stipe short .... 10 M. rubrophyllus
      - Taste neither strong nor acrid
        - Lamellae free, usually growing in lawns or grassy places .... 11 M. caryophylleus
        - Lamellae adnexed, growing in woods
          - Stipe spongy, thickened at base ..... 12 M. spongiosus

Stipe short, neither spongy nor thickened at base
Lamellae not dark in dry plants.. 13 M. dichrous
Lamellae becoming brown or reddish .... 10 M. rubrophyllus
Plants smaller, pileus rarely 2 cm broad
Stipe white or entirely covered with a white tomentum..................... 39 M. olneyi
Stipe not entirely white or covered with a white tomentum
Pileus umbonate........................16 M. umbonatus
Pileus not umbonate
Odor or taste strong or disagreeable
Lamellae annulate-adnexed; pileus umbilicate and striate............ 14 M. foetidus
Lamellae not annulate-adnexed; pileus not umbilicate; odor of onions .... 2 M. prasiosmus
Odor or taste neither strong nor disagreeable
Stipe slender, long-radicating; pileus red .... 15 M. elongatipes
Plants not as above
Stipe strigose-tomentose, at least in the lower part
Pileus striate or plicate
Stipe nearly smooth and dark above .... 17 M. semihirtipes
Stipe white-pubsecent above. 18 M. biformis
Pileus smooth, not striate
Some of the lamellae subdecurrent, darker in dry plants 19 M. contrarius
Lamellae not decurrent, usually pallescent
Stipe glabrous above...... 17 M. semihirtipes
Stipe not glabrous above
Lamellae rather broad, adnexed .... 12 M. spongiosus
Lamellae narrow, adnate. 20 M. velutipes
Stipe not strigose-tomentose
Margin of pileus little, if at all, striate
Stipe thickened upward; base tuberculose .... 13 M. dichrous
Stipe neither thickened upward, nor tuberculose
Stipe long................. 8 M. subnudus
Stipe short................ 10 M. rubrophyllus
Margin of pileus striate or plicate
Stipe long, even............. 8 M. subnudus
Stipe short, thickened upward 13 M. dichrous

II Pileus subfleshy to membranous; stipe smooth pruinose, or subtomentose; lamellae squarely adnate or decurrent, free in a few small plants with tomentose stipe

- Pileus white
  - Lamellae decurrent
    - Pileus papillate
      - Spores 10 μ or more long.............. 21 M. magnisporus
      - Spores less than 10 μ long
        - Lamellae close...................... 27 M. papillatus
        - Lamellae distant.................... 22 M. languidus
    - Pileus not papillate
      - Lamellae broad
        - Stipe bulbous; growing upon soil and buried twigs; spores 7–9 μ long.... 23 M. vialis
        - Stipe increasing upward; growing upon wood or other vegetable debris; spores 10–12 μ long.......... 21 M. magnisporus
      - Lamellae narrow
        - Lamellae and stipe with minute resinous particles or hairs.............. 24 M. resinosus
        - Lamellae and stipe without resinous particles or hairs..,.............. 25 M. salignus
  - Lamellae not decurrent
    - Cystidia present......................... 29 M. squamula
    - Cystidia absent
      - Spores irregularly angular............ 26 M. nigripes
      - Spores not angular
        - Odor strong........................ 28 M. perforans
        - Odor not strong
          - Stipe hollow, base swollen above and contracted to a point below...... 31 M. praeacutus
          - Stipe of uniform thickness
            - Stipe very short, upon herbaceous plants in swamps.............. 30 M. caricicola
            - Stipe not very short
              - Pileus not distinctly striate or plicate
                - Stipe pallid................. 32 M. opacus
                - Stipe becoming reddish...... 33 M. ramulinus
              - Pileus distinctly striate or plicate
                - Lamellae narrow, adnexed.. 34 M. phyllophilus
                - Lamellae broadly adnate..... 35 M. insititius
- Pileus not white
  - Lamellae decurrent
    - Pileus yellow to ferruginous............. 36 M. tomentosipes
    - Pileus not yellow or ferruginous
      - Stipe glabrous above.................. 37 M. alienus

Stipe not glabrous above............. 19 M. contrarius
Lamellae not decurrent
Pileus small, 2mm or less broad
Plant minute, pubescent................ 43 M. minutissimus
Plant not pubescent
Pileus smoky-brown, smooth......... 41 M. concinnus
Pileus pale straw color, striate....... 42 M. cucullatus
Pileus more than 2 mm broad
Stipe beset with white or tawny hairs... 15 M. elongatipes
Stipe not beset with hairs
Stipe brown or blackish............ 35 M. insititius
Stipe not brown or blackish
Stipe glabrous; pileus reddish-brown .... 38 M. leptopus
Stipe farinaceous or subtomentose
Pileus white with a reddish disk
Stipe contracted to a point below .... 31 M. praeacutus
Stipe not contracted to a point below .... 40 M. ramealis
Pileus rufescent................ 39 M. olneyi
Pileus pale-yellowish-brown then whitish, plicate-striate......... 35 M. insititius
III Pileus usually membranous; stipe smooth and shining except in a few small plants with a pileus less than 5 mm broad
Plants small; pileus usually less than 3 mm broad
Pileus white
1–2 mm board, smooth.................. 44 M. filopes
Small, less than 1 mm; hairy under a lens. 43 M. minutissimus
Pileus not white
Stipe pale straw colored.................. 42 M. cucullatus
Stipe neither yellow nor straw colored
Stipe blackish brown, shining.......... 45 M. minutus
Stipe pallid, brownish below
Cystidia present..................... 46 M. pirinus
Cystidia absent...................... 47 M. thujinus
Stipe white.......................... 41 M. concinnus
Plants larger; pileus usually over 3 mm broad
Pileus fleshy or subfleshy
Plants with odor of onions.............. 48 M. alliatus
Plants without odor of onions
Pileus white or light yellow
Stipe brown, mycelioid; cystidia present .... 50 M. delectans
Stipe reddish brown, not mycelioid; cystidia absent...................... 49 M. calopus
Pileus not white or light yellow
Cystidia present; lamellae broad..... 51 M. glabellus
Cystidia absent...................... 52 M. bellipes

- Pileus membranous
  - Pileus white
    - Lamellae attached to a free collar — 53 M. rotula
    - Lamellae not attached to a free collar
      - Stipe black, paler at apex — 56 M. albiceps
      - Stipe pale, straw colored — 57 M. straminipes
  - Pileus not white
    - Lamellae attached to a free collar
      - Pileus alutaceous to umber, umbilicate — 54 M. capillaris
      - Pileus reddish white, umbonate — 55 M. graminum
    - Lamellae not attached to a free collar
      - Pileus ochraceous, ochraceous-red, or brown
        - Cystidia present — 51 M. glabellus
        - Cystidia absent — 58 M. siccus
      - Pileus not colored as above
        - Lamellae purplish gray — 61 M. melanopus
        - Lamellae not purplish gray
          - Pileus campanulate, maroon or vinous red — 59 M. pulcheripes
          - Pileus convex to plane or depressed
            - Pileus red-brown or vinous red. — 45 M. minutus
            - Pileus fuscous, pinkish, or rarely whitish — 60 M. androsaceous

1 Marasmius polyphyllus Peck

Ann. Rep't N. Y. State Mus., 51 : 286. 1898.

Pileus fleshy, thin, convex or nearly plane, gregarious or cespitose, 2.5–5 cm broad; surface smooth, whitish to pale reddish brown, disk darker in dried plants; context having the odor and taste of onions; lamellae adnexed or nearly free, very crowded, narrow, white, becoming yellowish in dried plants; spores minute, 5–6 by 3–4 μ; stipe equal, hollow, 4–7 cm long, 2–4 mm thick, reddish brown, covered with a white tomentum which is more abundant toward the base.

Shaded damp ground. Minerva, Essex county. July 1st.

Peck says "the peculiar garliclike flavor of this mushroom remains in the mouth a long time after tasting the flesh. This species is closely related to M. prasiosmus Fr. from which it differs in its larger size, more crowded lamellae and smaller spores." It is interesting to note that Ricken's description of M. prasiosmus (Die Blätter. Deutschl.) differs little from this except in the size of the plant. It has been suggested that M. polyphyllus may be known in Europe as M. prasiosmus.

2 **Marasmius prasiosmus** Fr.

Epicr. Myc. 376. 1838.

Pileus submembranous, soft, campanulate, convex, expanded, obtuse, gregarious, 2–4 cm broad; surface rugulose-sulcate, glabrous, whitish or yellowish, disk darker; context with a strong odor of onions; lamellae attached, subcrowded, narrow, white; spores white, 12–15 by 3–4 μ; stipe fistulose, pallid, glabrous above, subtomentose and thickened downward, pallid, then rufous or fuscous, 5–8 cm long, 2 mm thick.

Upon old leaves in woods.

3 **Marasmius confluens** (Pers.) Ricken

Blätter. Deutsch. 72. 1911.

Fries, Epicr. Myc. 88. 1838 (As Collybia confluens (Pers.) (Fr.)

Pileus subfleshy, dry, broadly convex to plane, cespitose, 1.5–3.5 cm broad; surface smooth, pinkish brown, becoming yellowish brown or almost white in dry plants; margin thin, often involute even in old, dried plants; lamellae narrow, crowded, free, remote, white or slightly discolored in age; spores 7–8 by 3–3.5 μ; stipe equal, enlarged at the apex, hollow, brown, covered everywhere with dense white tomentum, bases of several plants bound together with dense whitish mycelium, 4–12 cm long, 2–5 mm thick.

Among dead leaves or moss. Common.

This species has generally been considered as a Collybia although it was recognized as having the characteristics of a Marasmius. Peck (Ann. Rep't N. Y. State Mus., 49:61) says "They revive under the influence of moisture and thereby indicate an intimate relationship to the genus Marasmius." Ricken l. c. describes this species as having cystidia which are lacking in our plant.

4 **Marasmius archyropus** (Pers.) Fr.

Epicr. Myc. 378. 1838.

Piles subfleshy, tough, convex to plane and depressed, gregarious or cespitose by the union of several plants by masses of mycelium at the base, 2–3 cm broad; surface alutaceous, pallascent, often becoming nearly white, glabrous; margin thin, involute, except in the mature plants, even, smooth; context moderately thin, tough, whitish; lamellae white, yellowish when dry, adnexed, crowded, narrow; spores 8 by 4 μ; stipe pale reddish, usually appearing gray

or white with a pruinose or tomentose coat, firm, rigid, stuffed or hollow, 11–14 cm long, 2–3 mm thick.

Among dead leaves in woods. Rather common.

This species is closely related to both M. confluens (Pers.) Ricken and to M. multifolius, Peck. From the former it may be distinguished by its longer, usually twisted stipe which is not enlarged at the apex and by the adnexed lamellae. It is not usually as densely cespitose as M. confluens. From M. multifolius it is distinguished by its longer stipe and the pallescent character of the pileus.

5 Marasmius multifolius Peck

N. Am. Flora, v. 9, pt 4, p. 270, 1915

Pileus subfleshy, tough, convex to plane, 2–3 cm broad; surface smooth, not striate, isabelline to pale fulvous, not fading in dry plants; lamellae narrow, crowded, adnate, white, changing but little in dry plants; spores 6 by 2.5–3 μ; stipe white-villous, firm, stuffed or hollow, 4–6 cm long, 2 mm thick.

Upon dead leaves in woods. Not common.

This seems to be a fairly distinct species which Peck collected several times and which he was apparently ready to publish as a new species. It differs from M. confluens (Pers.) Ricken in its adnate lamellae and in its not being densely cespitose.

6 Marasmius fasciatus Pennington

Ann. Rep't N. Y. State Mus., 24:76. 1872 (As M. anomalus Peck (not M. anomalus Lasch.).

Pileus subfleshy, tough, broadly convex to nearly plane, often subumbonate, densely cespitose, 2–4 cm broad; surface even, glabrous, reddish to tan, fading nearly to white in dried plants; lamellae rather close, narrow, adnexed, narrowed behind, white, sometimes reddish yellow in dried plants; spores 5–6 by 2.5–3 μ; stipe cartilaginous, even, hollow, smooth above, bound together below by dense white mycelium; reddish to dark red or almost black, 3–6 cm long by 2–3 mm thick.

Upon decayed wood and humus in forest. Not uncommon.

The original description of this plant was made from two rather immature plants. The description given above has been modified to agree with later collections and notes of Peck's. This is very close to European specimens distributed as M. lupuletorum (Weimm) Bres.

7 **Marasmius peronatus** (Bolt.) Fr.

Epicr. Myc. 375. 1838.

Pileus subfleshy, tough, broadly convex, sometimes subumbonate, 2–6 cm broad, surface rich brown with a reddish tint in dried plants, glabrous; margin lighter than the disk, smooth, somewhat irregular; context tough, coriaceous, whitish, the taste unpleasant, acrid; lamellae pallid to reddish, close, rather broad, adnexed; spores ovoid, 6–8 by 3–4 μ; stipe flavid to subrufous, equal, often compressed, villous-corticate, personate-strigose at the base.

Upon dead leaves in woods. Rare.

This species, which is often considered as identical with M. urens (Bull.) Fr. and is called M. urens-peronatus in Europe, seems to be very rare in America, although both forms have been rather frequently reported. The American specimens which most closely resemble those of Europe come from California. A few of Peck's collections are near enough to the European plants to pass as M. peronatus. Some of our collections may prove to be M. putillus Fr.

8 **Marasmius subnudus** (Ellis) Peck

Ann. Rep't N. Y. State Mus., 51:287. 1898.

Pileus subfleshy, thin, tough, flexuous, broadly convex to plane, gregarious or subcespitose, 2–4 cm broad; surface brownish red, dingy bay or russet, smooth, margin even, smooth or subtriate; context thin, tough, white, the taste unpleasant, bitter; lamellae pallid or yellowish, becoming darker in dried plants, narrow, subdistant, slightly adnexed or free, becoming remote in old, dried plants; spores 8–10 by 4.5 μ; stipe reddish brown to nearly black, covered with a dense white tomentum or nearly naked at the apex, slender, firm, equal, solid or stuffed, 4–8 cm long, 2–4 mm thick.

On ground among leaves and other vegetable debris in woods. Common.

This is undoubtedly one of the species that has often been reported as M. peronatus (Bolt.) Fr. or M. urens (Bull.) Fr.

9 **Marasmius iocephalus** (Berk. & Curt.) Pennington

Ann. Mag. Nat. Hist. II, 12:420. 1815 (Mycena iocephala Berk. & Curt.).

Pileus submembranous to membranous, broadly convex, gregarious or subcespitose, 1.5–4 cm broad; surface striate or sulcate, violet,

bluish gray at times in dried plants; context with a strong odor; lamellae adnate, distant, rather narrow, paler than the pileus; spores 7 by 3.5 μ; stipe attenuate upward, densely tomentose above, strigose below, white or yellowish, 4–5 cm long, 2–4 mm thick.

Upon dead leaves in woods and swamps. South eastern part of the State. Rare.

Peck has called New York specimens of this plant M. peronatus (Bolt) Fr. Ellis called this plant M. carneo-purpurens, but does not, however, seem to have published a description of the species. The purplish pileus and the strigose stipe plainly characterize the plant.

10 Marasmius rubrophyllus Pennington

North American Flora, v. 9, pt 4, p. 27. 1915

Pileus subfleshy, tough, broadly convex to nearly plane, often slightly depressed, gregarious, 1–4 cm broad; surface dry, smooth, reddish brown to dark alutaceous; margin even; lamellae adnexed or adnate, moderately close, narrow, reddish, becoming reddish brown in dried plants; spores 7 by 3.5 μ; stipe firm, even, short, reddish brown, uniformly covered with a white down or pruinose coat, 2–3 cm long, 1–2.5 mm thick.

Upon bark or wood, rarely among dead leaves. Rare.

This species has been called M. peronatus (Bolt.) Fr. in some local lists and M. plancus Fr. and M. erythropus (Pers.) Fr. in others.

11 Marasmius caryophylleus (Schaeff.) Schröt.

Krypt. Fl. Schles., 3:561. 1889.
Fries, Epicr. Myc. 375. 1838 (As M. oreades (Bolt) Fr.).

Pileus fleshy, tough, convex, plane or subumbonate, 3–5 cm broad; surface white to pale tan or reddish pallescent, glabrous; margin at first involute, smooth, even, sometimes reflexed in age or in dried plants; context somewhat tough, thick at the disk, whitish, the taste pleasant, the odor fragrant; lamellae white, yellowish when dry, broad, distant, free; spores 7–9 by 4–5 μ; stipe pallid, solid, corticate, with a villous, interwoven cuticle, appearing nearly smooth or slightly villous-pubescent, 4–5 cm long, 2–4 mm thick.

Upon lawns and grassy places. Common.

The coming "fairy ring" mushroom is practically the only species of Marasmius that is used for food. It has a wide distribution and is highly esteemed by the mycophagist. It has been shown that it is partially parasitic upon grass, often slowly killing it out in small areas.

12 **Marasmius spongiosus** Berk. & Curt.

Jour. Bot. & Kew Misc. 172. 1849.

Pileus fleshy, broadly convex, obtuse or plane, 1–3 cm broad; surface whitish fuscous, whitish brown, or tan, the center darker; lamellae slightly adnate, subcrowded, moderately broad, whitish; spores 7–9 by 3–4 μ; stipe 5–10 cm long, 2–4 mm thick, furfuraceous-pulverulent to villous, the base thickened, more or less spongy, tawny to dark brown or almost black, often rooting, the rooting portion being 3–5 cm long.

Among leaves and other vegetable debris in woods. Rather common.

There is much variation in size in this species where it is found in different localities. It is possible that two or more species are confused under this name. Since there are all gradations from large to small plants, size alone can scarcely be taken as a basis for distinguishing separate species. The smooth pileus, tawny to dark brown, villous stipe, which is often spongy or rooting at the base, and the light-colored lamellae characterize our plant. M. semisquarrosus Berk. & Cooke does not seem to be distinct. M. spongiosus may possibly be known in Europe as M. erythropus (Pers.) Fr. It is at least very close to M. erythropus (Pers.) Fr. [Ic. Hymen. pl. 174, fig. 2, and Cooke, Brit. Fungi pl. 1123, B(1077.B).]

13 **Marasmius dichrous** Berk. & Curt.

Ann. Mag. Nat. Hist. II, 12:426.

Bul. Buffalo Soc. Nat. Sci., 1:58. 1873 (As Marasmius caespitosus Peck).

Jour. Cinc. Soc. Nat. Hist., 6:192. 1883 (As Marasmius fagineus Morgan).

Pileus subfleshy, convex, at length plane or depressed, 2–4 cm broad, gregarious or cespitose; surface not polished, dry, nearly smooth to rugose-striate, reddish or purplish pallid to alutaceous, becoming brown in dried plants; lamellae adnate, often becoming nearly free, close, narrow in front, often crisped, pale reddish;

spores often guttulate, 8–10 by 4.5–5 μ; stipe short, hollow, thickened upward, the base subtuberculose, reddish pallid, brown or dark reddish brown, pruinose or slightly pubescent at the base, 1–3 cm long, 2 mm thick.

Upon twigs, bark, wood and other vegetable debris in woods. Rather common.

M. dichrous is usually found upon bark or wood. The smoky brown color of the pileus in dried plants and the short stipe with its slightly tuberculose base are generally sufficient to characterize this species.

14 Marasmius foetidus (Sow.) Fr.

Epicr. Myc. 380. 1838.

Ann. Rep't N. Y. State Mus., 55:648. 1889 (As Marasmius acerinus Peck).

Pileus submembranous, soft, convex, then explanate, umbilicate, 10–20 mm broad, surface subpruinose, fulvo-badius or fox-brown, fading in dry plants; margin striate-plicate; at first involute, lax or dropping; context with a strong, disagreeable odor; lamellae annulate-adnexed, not broad, distant, reddish yellow; spores 7–8 by 4 μ; stipe pruinose, base minutely floccose, hollow, spadiceous, darker below, 1–2.5 cm long, 2 mm thick.

Upon dead branches and other vegetable debris in woods.

Rather common, widely distributed in northeastern United States and Canada; also in Europe. Since the disagreeable odor is not marked except in moist or very fresh plants, collections of M. foetidus are frequently referred to other species.

15 Marasmius elongatipes Peck

Bul. Buffalo Soc. Nat. Sci., 4:181. 1883.

Ann. Rep't N. Y. State Mus., 26:66. 1874 (As Marasmius longipes Peck).

Bot. Sur. Neb., 4:20 1896 (As Marasmius hirtipes Clements).

Pileus thin, submembranous, convex, 8–13 mm broad; surface glabrous, finely striate, fulvous-red; lamellae narrow, adnexed, not crowded, white; spores 7–8 by 3.5 μ; stipe equal, long, slender, radicate, hollow, brown or alutaceous, white at apex, pruinose to white-tomentose, often with white hairs, 5–13 cm long, 1 mm thick.

Upon ground among dead leaves in woods. Common.

This species varies especially in respect to the long radicating stem which may appear brownish tomentose or brown with minute

white hairs. Specimens of M. chordalis Fr. from Sweden seem to be very close to M. elongatipes except that the texture of the stipe is more firm in M. elongatipes than in M. chordalis.

16 **Marasmius umbonatus** Peck

Bul. Buffalo Soc. Nat. Sci., 1:58. 1873.

Pileus thin, tough, expanded, umbonate, gregarious, 13–19 mm broad; surface glabrous, alutaceous, margin smooth or substriate, at first incurved; lamellae interveined, branched in front, reaching the stipe, subdistant, narrow, white; spores 7–8 by 3.5 μ; stipe equal, solid, fulvous above, pallid below, velvety tomentose, 2.5–4 cm long, 1 mm thick.

Among needles of coniferous trees. Not common.

17 **Marasmius semihirtipes** Peck

Bul. Buffalo Soc. Nat. Sci., 1:57. 1873.

Pileus thin, tough, convex to nearly plane or depressed, 1–2 cm broad; surface glabrous, reddish brown, becoming alutaceous, the disk darker, margin sometimes striate; lamellae slightly adnexed, subdistant, not narrow, white; spores 8–9 by 4.5 μ; stipe equal, even or finely striate, tubular, reddish brown, often nearly black in dry plants, glabrous above, velvety tomentose toward the base, 3–5 cm long, 1–2 mm thick.

Upon ground among dead leaves etc., in woods. Rather common.

Marasmius semihirtipes varies considerably in color and striation of the pileus and in the color and roughness of the stipe.

18 **Marasmius biformis** Peck

N. Y. State Mus. Bul. 67, p.25. 1903.

N. Y. State Mus. Bul. 105, p.25. 1906) (As Marasmius longistriatus Peck).

Pileus submembranous, thin, campanulate or nearly plane, often becoming umbilicate, gregarious, 8–16 mm broad; surface glabrous, hygrophanous, striatulate when moist, rugose-striate when dry, bay-red or pale chestnut when moist, grayish when dry, lamellae adnate and joined together at the stipe, rather close, not broad, grayish or creamy yellow; spores 5–6 by 3.5 μ; stipe even, slender, brown

when moist, cinereous when dry, densely downy-pubescent, base often tawny, 2.5 cm long, 1 mm thick.

Under coniferous trees. Infrequent.

Peck (N. Y. State Mus. Bul. 67, p. 25. 1903) says: "The species is closely related to M. subnudus, (Ell.) Pk. but the plant is much smaller, the pileus is usually umbilicate and the stem not inserted. The mycelium binds together a mass of dirt and needles which adhere to the base of the stem when the plant is taken from the ground. In some groups nearly all the pilei are campanulate, in others they are nearly plane. This feature is suggestive of the specific name." A comparison of types and descriptions forces one to the conclusion that M. biformis and M. longistriatus are too nearly identical to be regarded as distinct species.

19 **Marasmius contrarius** Peck

N. Y. State Mus. Bul. 150, p.34. 199.

Pileus submembranous, tough, broadly convex or nearly plane, gregarious, 4–10 mm broad; surface often uneven, glabrous, whitish or white with brown center, becoming grayish or subalutaceous in drying; lamellae adnate or slightly decurrent, subdistant, thin, sometimes branched or irregular, interspaces slightly venose, whitish; spores 7–9 by 4–5 μ; stipe slender, white within, solid, grayish-tawny, downy, tomentose at base, 2–3 cm long, 1–1.5 mm thick.

Damp mossy places under spruce and balsam trees. Not common.

20 **Marasmius velutipes** Berk. & Curt.

Ann. Mag. Nat. Hist. III, 4:295. 1859.

Pileus submembranous, tough, plane or umbilicate, gregarious, 8–20 mm broad, surface dull chestnut to ochraceous brown, lighter or pallescent at the center, smooth; margin at first involute, thin, even, smooth, often becoming striate; context thin, tough, white or whitish; lamellae white, becoming yellowish, narrow, close, adnate; spores 6.5 by 4–4.5 μ; stipe reddish brown, covered above with whitish tomentum, below with tawny yellow to brown hairs, flexuous, equal or swollen and spongy below, hollow, often rooting, 3–5 cm long, 1–2 mm thick.

Among dead leaves of deciduous trees. Rather common.

21 Marasmius magnisporus Murrill

Mycologia 4:166. 1912.
Ann. Rep't N. Y. State Mus., 41:85. 1888 (As M. salignus major Peck).

Pileus thin, tough, convex, at times umbonate, cespitose or closely gregarious, 1–1.5 cm broad; surface glabrous, white to pale isabelline with a pinkish tint; margin sometimes slightly striate; lamellae squarely adnate or decurrent, distant, broad, strongly interveined, inserted, white, entire; spores oblong, 10–12 by 4–6 μ; stipe increasing upward, tough, grayish avellaneous below, paler above, minutely striate, pruinose to glabrous, 1–3 cm long, 2 mm thick.

Upon dead wood. Not common but widely distributed over the temperate parts of North America.

Marasmius magnisporus has probably been reported from many parts of America and possibly from Europe as M. candidus (Bolt.) Fr. and M. languidus (Lasch.) Fr.

22 Marasmius languidus (Lasch.) Fries

Epicr. Myc. 379. 1838.

Pileus subfleshy, convex, gibbous or umbilicate, 1–2 cm broad; surface flocculose, white, pallid, margin rugose-sulcate; lamellae adnate-decurrent, interveined, distant, narrow; spores 6 by 4 μ; stipe increased above, stuffed, pallid, brownish below, surface naked, 2.5 cm long, 1–2 mm thick.

Upon dead stems, grass, leaves etc. Rare.

23 Marasmius vialis Peck

Ann. Rep't N. Y. State Mus., 51:287. 1898.

Pileus membranous, convex, 4–10 mm broad; surface pruinose, white; lamellae decurrent, distant, arcuate, white, becoming yellow-brown in dried plants; spores 7–9 by 4–4.5 μ; stipe bulbous, short, solid, tough, substance white then brown or black, surface white-pruinose, 12–20 mm long, 1 mm thick.

Upon dead roots and twigs buried in damp ground. Not common.

24 **Marasmius resinosus** (Peck) Sacc.

Syll., 5:522. 1887.

Ann.. Rep't N. Y. State Mus., 24:88. 1872 (As *Marasmius decurrens* Peck).

N. Y. State Mus. Bul. 67, p.38. 1903 (As *Marasmius resinosus nivens* Peck).

N. Y. State Mus. Bul. 94, p.40. 1905 (As *Marasmius resinosus candidissimus* Peck).

Pileus thin, convex, subcespitose, 8–13 mm broad; surface minutely tomentose, pure white, becoming yellowish when dry; lamellae arcuate-decurrent, interspaces rugose-reticulate, subdistant, narrow, tapering toward each end, white, the edges discolored; spores 6–7 by 4 μ; stipe slender, firm, equal, white, surface minutely tomentose, 2.5–5 cm long, 1 mm thick. The stipe and lamellae are usually dotted with minute, resinous, granular particles.

Upon vegetable debris upon ground. Common.

The pure white color of the pileus is frequently obscured by the substratum within or upon which the plant grows, which sometimes gives it a grayish or brownish appearance.

25 **Marasmius salignus** Peck

Ann. Rep't N. Y. State Mus., 35:135. 1884.

Pileus submembranous, convex or plane, sometimes subumbilicate, 4–10 mm broad; surface dry, glabrous or subpruinose, white, margin even; lamellae often joined at the base, rarely forking, adnate, subdistant, narrow, white; spores ovoid or subellipsoid, 6–7 by 4 ; stipe slender, stuffed, reddish brown, slightly furfuraceous or pruinose, 1.5–2.5 cm long, 1 mm thick.

Upon the bark of trees. Not common. This species seems to be very closely related to *M. candidus* (Bolt.) Fr. Some of Peck's collections might well pass for the plant figured by Bolton (Hist. Fung. pl. 39, fig. D.)

26 **Marasmius nigripes** (Schw.) Fries

Epicr. Myc. 383. 1838.

Pileus membranous, 6–12 mm broad, campanulate, umbonate; surface white, pruinose, pellucid, margin striate; lamellae adnate, broad, white or pallid, becoming dark in dried plants; spores angular, 8–9 μ; stipe insititious, slightly tapering downward, horny, blackish, white-pruinose, becoming brown in dried plants, 3.5–4 cm long, 1–2 mm thick.

Upon leaves, twigs etc., in woods. Rare in New York but common in Ohio and Michigan. Marasmius nigripes is readily distinguished from all other species of Marasmius by its irregularly angular spores.

27 **Marasmius papillatus** Peck

Ann. Rep't N. Y. State Mus., 24:76. 1872.

Pileus submembranous, convex to expanded, papillate, gregarious, 1–2 cm broad; surface obscurely striate, sordid white or gray, sometimes with a pink tint; margin fluted in dry plants; lamellae adnate with slightly decurrent tooth, some decidedly decurrent, crowded, narrow, white or yellowish; spores 8–9 by 3.5 μ; stipe slender, deeply radicating, firm, hollow, concolorous, white-pruinose, 2.5–5 cm long, 1–2 mm thick.

Upon mossy logs in woods. Common in the Adirondack mountains.

28 **Marasmius perforans** (Hoffm.) Fries

Epicr. Myc. 385. 1838.

Pileus submembranous, plane, not umbilicate, 8–12 mm broad; surface rugulose, glabrous, pallid white, margin not striate; context with a stinking odor, not of onions; lamellae adnate, many dimidiate, simple, crowded, whitish; spores 6–8 by 2–4 μ; stipe equal, hollow, brownish black, velvety, 2–3 cm long.

Upon dead leaves of fir; occasionally upon leaves of other kinds. Common.

This plant has been distributed as Marasmius abietis (Batsch.) Fr. The plant which Batsch figures and describes as M. agaricus abietus seems to be another species, possibly M. alliatus (Schaeff.) Schröt.

29 **Marasmius squamula** (Batsch.) Pennington

North American Flora, v.9, pt 4, p. 277. 1915.
Epicr. Myc. 386. 1838 (As Marasmius epiphyllus Fr.).
Ann. Rep't N. Y. State Cab., 23:175. 1872 (As Marasmius subvenosus Peck).

Pileus membranous, plane, at length subumbilicate, 2–10 mm broad; surface plicate, rugose, milk-white, often becoming light brown in age, margin not striate; lamellae adnate, few, rather narrow, often veinlike, distant, venose-connected, white; spores

8–9 by 3 μ; cystidia awl-shaped, 25–30 by 5 μ; stipe equal, inserted, horny, fistulose, brown below, light above, pruinose or very slightly velvety, 2–5 cm long, 5–1 mm thick.

Upon dead herbaceous stems, leaves, twigs etc. Common.

30 Marasmius caricicola Kauff.

North American Flora, v.9, pt 4, p. 277. 1915.
Mich. Geol. Sur. Bul. 1915.

Pileus membranous, somewhat tough, pliant, convex-expended, obtuse, gregarious, 4–8 mm broad; surface broadly sulcate or alveolate, pruinose, pure white; lamellae thick, adnate, very distant, rather broad, pure white; spores 15–18 by 6–6.5 μ; basidia 2-spored or 4-spored; stipe very short, terete, equal, subglabrous, pure white, inserted by a naked base, 2 mm long, .7 mm thick.

Upon stems of sedges in marshes. Not yet reported from New York. It is not unlikely that it may yet be found within the State. It is easily overlooked because of its small size.

31 Marasmius praeacutus Ellis

Torrey Club Bul. 6, p.76. 1876.

Pileus membranous, convex to expanded, subumbilicate, 6–10 mm broad; surface pulverulent, white, the disk red-tinged; margin at first incurved, subsulcate, striate; lamellae adnate, more or less forked, hardly crowded, narrow, white; spores 5–6 by 3 μ; stipe swollen below but contracted to a point at the base, hollow, reddish brown, white at the base, pulverulent, 2.5 cm long, 1 mm thick. In young plants, the swollen part of the stipe constitutes nearly the entire plant.

Upon dead leaves, twigs, and bark in woods. Rare.

The peculiar appearance of the young plants and the marked constriction of the stipe at its base easily distinguish this species.

32 Marasmius opacus Berk. & Curt.

Jour. Bot. & Kew Misc., 1 :99. 1849.

Pileus submembranous, convex, often slightly depressed around a central umbo, 5–8 mm broad; surface rugulose, scarcely striate, opaque, pulverulent, white; lamellae adnexed, distant, ventricose; spores 6–7 by 3 μ; stipe institious, elongate, pulverulent, subfurfuraceous, pallid, 2.5–4 cm long, 1 mm thick.

Fallen leaves and branches. Not yet reported from New York. It is not unlikely that it will be found in the southern part of the State, since it occurs in Ohio.

33 **Marasmius ramulinus** Peck

Ann. Rep't N. Y. State Mus., 51:286. 1898.

Pileus very thin, submembranous, broadly convex, subumbilicate, 4–8 mm broad; surface white, margin nearly even to irregularly plicate-striate; lamellae adnate, rather close, white; spores 7–8 by 3.5–4 μ; stipe slender, inserted, whitish, becoming tawny-red, stuffed, minutely downy or pruinose, 12--18 mm long.

Upon dead twigs and herbaceous stems. Rare.

34 **Marasmius phyllophilus** Peck

N. Y. State Mus. Bul. 116, p.26. 1907.

Pileus membranous, convex or nearly plane, gregarious, 8–16 mm broad; surface dry, strongly rugose-striate or rugose-sulcate, whitish with a faint pinkish tint when dry; lamellae adnexed, distant, narrow, rounded behind, whitish, the interspaces venose; spores 5–6 by 3–4 μ; stipe inserted, slender, equal, tough, hollow, white, covered with whitish downy or velvety pubescence, 20–30 mm long, 1 mm thick.

Upon dead leaves. Rare.

35 **Marasmius insititius** Fries

Epicr. Myc. 386. 1838.

Pileus membranous, convex to plane or subumbilicate, 6–12 mm broad; surface not polished, pale yellowish brown, then whitish, margin becoming plicate-sulcate; lamellae unequal, simple, broadly adnate, distant, narrow in front, pallid; spores 4 by 2 μ; stipe inserted, horny, hollow, reddish brown, floccose-furfuraceous, 2–3 cm long, 1 mm thick.

Upon dead leaves and twigs. Not uncommon.

36 **Marasmius tomentosipes** Peck

Torrey Club Bul. 29, p.71. 1902.

Pileus thin, convex, becoming nearly plane, generally umbilicate, gregarious or subcespitose, 1–3.5 cm broad; surface glabrous, widely striate on the margin when moist, golden yellow, brownish

yellow, or ferruginous, often becoming brown with age; lamellae adnate or decurrent, subdistant, thin, arcuate, pale yellow; spores 6–7 by 3–4 μ; stipe tough, elastic, hollow, blackish brown, covered with tawny tomentum which forms minute, meallike patches at the apex and a more or less dense mat at the base, 2–6 cm long, 1–1.5 mm thick.

Upon vegetable mold, often among grass and moss. Not uncommon.

This species has a wide distribution in America as well as in Europe. It seems to have been known in America as M. velutipes (Clements, Crypt Form. Colo. 182) and as M. flammans Cooke (not Berk. 1856) (Rav. Fungi Am. 467). In Europe it seems to be known as M. cauticinalis (Sw.) Fr. or M. caulicinalis. (Not M. Agaricus cauticinalis Bull.) Specimens from Romell in Sweden under the name M. cauticinalis fulvo-bulbilosus seem to be identical with our New York form. Fries says of M. cauticinalis (Epicr. Myc. 1838) that it is very similar to Omphalia campanella. Peck (N. Y. State Mus. Bul. 67) says, "Similar in color to Omphalia campanella, but differing in its more scattered mode of growth, its longer stem sprinkled with tawny mealy particles, and in its less distinctly umbilicate pileus."

37 Marasmius alienus Peck

N. Y. State Mus. Bul. 139, p.25. 1910.

Pileus thin, tough, convex, 6–10 mm broad; surface dry, subpruinose, pallid or pale buff; margin thin, straight, striate in dry plants; lamellae subarcuate, slightly decurrent, distant, creamy yellow, becoming brownish; spores 8–10 by 4–5 μ, oblong or narrowly ellipsoid; stipe firm, slender, hollow, pallid, subpruinose, 2.5–5 cm long, .5–1 mm thick.

Upon mossy, prostrate tree trunks. Rare.

38 Marasmius leptopus Peck

N. Y. State Mus. Bul. 67, p.25. 1903.

Pileus thin, broadly convex or nearly plane, 6–10 mm broad; surface glabrous, reddish brown; margin obscurely or rugosely striate; lamellae adnate, close, thin, narrow, white; spores oblong or narrowly ellipsoid, 7.5–9 by 3–4 μ; stipe slender, inserted, hollow, whitish or pallid, glabrous, 2.5–4 cm long, 1 mm thick.

Upon dead leaves. Not uncommon.

39 Marasmius olneyi Berk. & Curt.

Ann. Mag. Nat. Hist. III 4:295. 1859.

Pileus membranous, convex, then plane or depressed, 8–10 mm broad; surface glabrous, dull-rufescent, margin striate at first, then radiately rugose; lamellae joined to a collar which may become free, subdistant, white, the edges slightly crenulate; spores 9–11 by 4–5 μ; stipe pulverulent-tomentose, white, 3.5–4 cm long.

Upon dead twigs. Not reported from New York. It is not unlikely that this species will be found within the State, since it has been reported from both Rhode Island and Michigan.

40 Marasmius ramealis (Bull.) Fries

Epicr. Myc. 381. 1838.

Pileus subfleshy, plane or depressed, obtuse, 4–9 mm broad; surface rugulose, opaque, white, disk with a reddish tint, margin not striate; lamellae adnate, connected behind, subdistant, narrow, white; spores ovoid, apiculate, 8–10 by 3–3.5 μ; stipe short, stuffed, white, reddish below, farinaceous, 12–18 mm long, 1 mm thick.

Upon dead twigs and branches in woods. Not common.

41 Marasmius concinnus Ellis & Ev.

Proc. Acad. Nat. Sci. 1893.

Pileus minute, convex, cespitose, 1 mm broad; surface pruinose, smoke-brown; lamellae adnate, subdistant, pruinose, the edges obtuse; spores globose, hyaline, 3 μ; stipe attenuate above, white, hairy strigose below, pruinose-pubescent at the apex, 2 mm long.

Upon dead Euonymus twigs. Known only from New Jersey.

Further observations are needed to determine whether this is a good species or merely a small form of M. ramealis (Bull.) Fr. or other related species.

42 Marasmius cucullatus Ellis

Torrey Club Bul. 6, p.76. 1876.

Pileus thin, campanulate, 1–2 mm broad; surface sulcate-striate, closing around the stipe when dry, pale straw color; lamellae adnate, about 12, of unequal length, paler than the pileus; spores not found; stipe slender, pale straw color, with thin white tomentum at the base, 5–10 mm long.

Upon dead twigs of Vaccinium corymbosum. Reported from New Jersey only.

Further observations and studies are necessary to determine whether this is a distinct species or only an immature form of some other species.

43 Marasmius minutissimus Peck

Ann. Rep't N. Y. State Mus., 27:97. 1878.

Pileus minute, convex or expanded, .5–1 mm broad; surface white, pubescent, with minute, simple or glandular hairs 30 μ long; lamellae few, narrow, often veinlike or almost wanting; spores not found in the type specimens; stipe capillary, minutely pubescent like the pileus, blackish brown below, pellucid white above.

Upon dead leaves. Rare, probably often overlooked on account of its extremely small size. The minute size and gland-tipped hairs characterize this species. After examining the type specimens of M. minutissimus and reading the description of Eomycenella echinocephala Atk. (Bot. Gaz., 34: 37. 1902) one can not help thinking that the two plants are the same species.

44 Marasmius filopes Peck

Ann. Rep't N. Y. State Mus., 24:77. 1872.

Pileus membranous, delicate, convex, subumbilicate, 2 mm broad; surface white, distantly and obscurely striate; lamellae about 6–8, adnexed to a collar, few, distant, white; spores 7–8 by 3 μ; stipe elongate, filiform, flexed, whitish, glabrous, brownish at the base, 2.5–4 cm long.

Upon dead fir needles. Not common.

45 Marasmius minutus Peck

Ann. Rep't N. Y. State Mus., 27:97. 1875.

Pileus membranous, convex, 2–4 mm broad; surface glabrous, reddish brown, sometimes almost vinous red, margin striate-sulcate; lamellae unequal, distant, subvenous, sometimes branched, white; spores 8 by 3.5–4 μ; stipe capillary, blackish brown, glabrous, shining, 2.5 cm long.

Upon dead leaves, especially those of black ash. Not common.

46 Marasmius pirinus Ellis

Torrey Club Bul. 8, p.64. 1881.

Pileus membranous, hemispheric, slightly umbilicate, minute, 1–1.5 cm broad; surface sulcate-striate, atomat or spiny under a lens with ovoid, pointed cells, at first pallid, becoming chestnut; lamellae few, distant, white; spores obovoid, 7–8 by 2.5–3 μ; cystidia oblong-fusoid, narrowed to a point above, 12–13 μ long; stipe filiform, pallid above, often striate, 6–7 mm long.

Upon dead leaves of pear trees. Rare.

47 Marasmius thujinus Peck

N. Y. State Mus. Bul. 67, p.26. 1903.

Pileus membranous, hemispheric or convex, often subumbilicate, 2–3 mm broad; surface subglabrous, minutely pulverulent-tomentose under a lens, cinereous, tinged with lilac, margin distantly striate; lamellae adnate, few, distant, white; spores ellipsoid, pointed 7–8 by 3–4 μ; stipe capillary, inserted, pallid, dry, pellucid, glabrous, at times slightly brownish or minutely floccose at the base, 12–24 mm long, scarcely thicker than a hair.

Upon dead leaves of Thuja occidentalis. Rare.

48 Marasmius alliatus (Schaeff.) Schröt.

Epicr. Myc. 379. 1838 (As Marasmius scorodonius Fries).

Pileus soft, fleshy, soon expanded, 1–2 cm broad; surface at first even and rufous, soon becoming smooth, rugulose, crisped and white; context having a strong odor of onions; lamellae adnate, crisped, white; spores 6–8 by 3–4 μ; stipe firm, horny, hollow, equal or enlarged above, red or reddish brown, glabrous, shining, 2–4 cm long, 1–2 mm thick.

Upon decaying vegetable debris in woods. Common. "Odor of skunk cabbage." Peck. Although the American plant is considered to be the same as the European, there is a constant difference in the character of the stipe. In our form the stipe is much firmer and more rigid than in the European form.

49 Marasmius calopus (Pers.) Fries

Epicr. Myc. 379. 1838.

Pileus soft, fleshy, convex to plane or depressed, 8–18 mm broad; surface smooth, becoming rugulose, light yellow or white; lamellae

emarginate-adnexed, thin, white; spores 7 by 4 μ; stipe equal, reddish brown, glabrous, not mycelioid, shining.

Upon dead leaves and grass. Not common. This species seems to differ from M. alliatus (Schaeff.) Schröt. chiefly in the absence of the odor of onions, which is not noticeable in one and very marked in the other.

50 **Marasmius delectans** Morgan

Jour. Myc. 11:206. 1905.

Pileus subcoriaceous, convex, then expanded and depressed, 1–2 cm broad; surface glabrous, rugulose, white, changing in drying to yellow or pale alutaceous; lamellae emarginate-adnexed, subdistant, slightly venose-connected, moderately broad, unequal, white; spores lance-oblong, 7–9 by 4 μ; stipe long, slender, slightly tapering upward, arising from abundant white mycelium, glabrous, shining brown, white at the apex, 3–5 cm long, 1–1.5 mm thick.

Upon dead leaves of deciduous trees. Not common. Reported as M. calopus (Pers.) Fr.

51 **Marasmius glabellus** Peck

Ann. Rep't N. Y. State Mus., 26:66. 1874.

Pileus membranous, convex to expended, 6–15 mm broad; surface dark ochraceous, often roughened on the disk, pruinose with cystidia, margin distantly striate; lamellae free, unequal, interveined, distant, broad, ventricose, whitish; spores 9 by 4.5 μ; cystidia pointed, 30–40 μ long; stipe horny, hollow, reddish brown or chestnut, glabrous, shining, white at the apex, equal or thickened and myceloid at the base, 2.5–5 cm long, 1 mm thick.

Upon dead leaves in woods. Not uncommon.

52 **Marasmius bellipes** Morgan

Jour. Myc. 11:207. 1905.

Pileus thin, subfleshy, campanulate, then expanded, 1.5–2.5 cm broad; surface glabrous, pale pinkish to purplish, margin plicate-sulcate; lamellae approximate, subdistant, moderately broad, equal, white; spores lanceolate, 10–12 by 3–4 μ; stipe long, slender, thicker upward, brown and shining below, purplish at the apex, glabrous, arising from abundant mycelium, 4–6 cm long, 1 mm thick.

Upon dead leaves of deciduous trees. Not uncommon. Reported by Peck as M. glabellus Peck, although the lamellae are narrower not ventricose and cystidia are lacking.

53 **Marasmius rotula** (Scop.) Fries

Epicr. Myc. 385. 1838.

Pileus membranous, convex, umbilicate, gregarious or subcespitose, 3–10 mm broad; surface plicate, not polished, whitish, often light brown in dried plants, disk sometimes darker; lamellae few, broad, distant, joined together behind into a free collar, whitish; spores 6–8 by 3–4 μ; stipe fistulose, horny, smooth, shining, blackish brown, inserted or arising from rhizomorphic strands, 2–5 cm long.

Upon dead leaves, wood and bark in woods. Very common.

54 **Marasmius capillaris** Morgan

Jour. Cinc. Soc. Nat. Hist., 6:194. 1883.

Pileus membranous, convex, umbilicate, 2–5 mm broad; surface plicate–sulcate, very minutely wrinkled, alutaceous to umber, white at the center; lamellae equal, broad, white, attached to a free collar; spores 8–10 by 4–5 μ; stipe capillary, very long, inserted, black, paler at the apex, glabrous, shining, 5–6 cm long.

Upon old leaves and sticks in woods. Not common. This species seems to differ from M. rotula Fr. in its constantly smaller size and brownish pileus with white center.

55 **Marasmius graminum** (Lib.) Berk. & Br.

Berk. Outl. Brit. Fungol. 222. 1860.

Pileus membranous, convex to plane, umbonate, 3–6 mm broad; surface reddish white, becoming darker in dried plants, margin sparingly sulcate; lamellae free with collar, equal, distant, whitish; spores 8–9 by 4–5 μ; stipe capillary, tough, black or pallid at the apex, glabrous, shining.

Upon dead grass. Not uncommon.

It is doubtful if this species is distinct from M. Curreyi Berk. & Br. The only difference in the descriptions of the two species is in the size of the spores, which are given as subglobose 3–4 μ for M. graminum and 9 by 5–6 μ for M. Curreyi. It is very possible that the spore measurements of M. graminum are based upon immature plants.

56 Marasmius albiceps Peck

Ann. Rep't N. Y. State Mus., 43:67. 1890.

Pileus membranous, convex or campanulate, 5 mm broad; surface glabrous, white; lamellae adnate or arcuate-decurrent, distant, broad, white; spores obovoid, 6–7 by 3–4 μ; stipe horny, setiform, black, paler at the apex, glabrous, growing from a brown mycelium, 16–36 mm long.

Upon dead branches in woods. Rare. In older plants the lamellae are strongly decurrent as in Omphalia fibula Fr.

57 Marasmius straminipes Peck

Ann. Rep't N. Y. State Mus., 26:66. 1874.

Pileus membranous, hemispheric or convex, 2.5–8 mm broad; surface glabrous, white, margin striate; lamellae adnexed, distant, unequal, white, yellow in drying; spores 7 by 3.5 μ; stipe horny, filiform, pale straw color, pallid when dry, brownish at the base, glabrous, shining, 2.5–5 cm long.

Upon dead needles of Pinus rigida. Rare.

58 Marasmius siccus (Schw.) Fries

Epicr. Myc. 382. 1838.

Ann. Rep't N. Y. State Cab., 23:126. 1872 (As Marasmius campanulatus Peck).

Bot. Sur. Nebr., 4:20. 1896 (As Marasmius fulviceps Clements).

Syll. Fung., 14:101. 1899 (As Marasmius clementsianus Sacc. & Sydow.).

Pileus membranous, convex or campanulate, solitary or gregarious, 6–15 mm broad; surface dry, glabrous, ochraceous, sometimes pink, rarely gray in dry plants; margin radiate-sulcate; lamellae subfree, narrowed behind, few, distant, broad, white; spores 12–15 by 6–7 μ, sometimes 20 μ long; stipe slender, not capillary, tough, hollow, blackish brown, glabrous, shining, 2.5–5 cm long, 1–2 mm thick.

Upon dead leaves in woods. Very common.

There is some variation in the size and color in different collections of this species. There is, however, less difference between the type specimens of M. campanulatus Pk., M. siccus (Schw.) and M. clementsianus Sacc. and Sydow (M. fulviceps Clements) than there is between different collections of M. campanulatus made by Peck and deposited by him in the New York State Museum. Like many other species of Marasmius, the spores vary in length. It is claimed that mature spores

of this species may elongate considerably as if beginning to germinate before they are shed.

59 Marasmius pulcheripes Peck

Ann. Rep't N. Y. State Mus., 24:77. 1872.

Pileus membranous, campanulate, obtuse, 4–8 mm broad; surface distantly striate, dry, glabrous, soft maroon or vinous-red; lamellae free, few, distant, ascending, narrow; spores 12–14 by 4 μ; stipe strict, brownish black, clear red at the apex, glabrous, shining, 2.5–4 cm long, .5 mm thick.

Upon dead leaves and sticks in woods. Not uncommon. This species might be considered as one of the many forms of M. siccus (Schw.) Fr. Its red or purple color and small size are usually sufficient, however, to distinguish it from forms of M. siccus.

60 Marasmius androsaceus (L) Fries

Epicr. Myc. 385. 1838.

Pileus membranous, convex, subumbilicate, 3–12 mm broad; surface glabrous, fuscous or often with a pinkish tint, sometimes nearly white, margin striate; lamellae simple, distinct, subdistant, adnate, whitish; spores ovoid-ellipsoid or oblong, 6–9 by 3 μ; stipe horny, contorted and sulcate when dry, hollow, black, glabrous, 2–5 cm long, .5 mm thick.

Upon dead leaves in woods usually under conifers, especially pine. Very common.

Peck (Ann. Rep't N. Y. State Mus., 41:85, 1888) says that the pale form grows upon fallen needles of spruce trees and the one with fuscous pileus upon fallen pine needles.

61 Marasmius melanopus Morgan

Jour. Cinc. Soc. Nat. Hist., 18:36. 1895.

Pileus membranous, convex, 4–6 mm broad; surface glabrous, purplish gray, margin not striate; lamellae adnate, subdistant, rather broad, purplish gray; spores obovoid, apiculate, 5–6 by 2.5 μ; stipe slender, hollow, black, shining, smooth, 2–4 cm long.

Upon dead leaves of deciduous trees. Not uncommon.

Closely related to M. androsaceus (Bull.) Fr. from which it may be distinguished by its colored lamellae and pileus without striation. M. melanopus seems to be confined to leaves of deciduous trees while M. androsaceus is usually found upon needles of conifers.

THE FUNGI OF NORTH ELBA

BY C. H. KAUFFMAN

For the purpose of obtaining, for the Cryptogamic herbarium of the University of Michigan, a representative collection of the fungi of the Adirondacks, a trip was planned to the collecting grounds of Doctor Peck at North Elba. The writer was accompanied by Mr E. B. Mains as assistant, and the collecting was done between August 31 and September 21, 1914. We located at the south end of the town of Newman. During the three weeks of our stay the weather was extremely propitious for the growth of fungi. For several weeks before our arrival and during most of the time thereafter, it rained heavily and almost continually. As a result the fungi, especially the Agarics, were to be found in such abundance that we are able to add a large number of records to the already large list of Doctor Peck.[1] The region covered has in a general way a radius of 3 or 4 miles from Newman. This, it should be noted, is a very small part of the territory studied by Doctor Peck.

The most striking characteristic of this region is the abundance of species of Cortinarii. These are, however, largely limited to the subgenera Telamonia, Dermocybe, and Hydrocybe. This is in sharp contrast to the flora of a region of hardwoods like that of southern Michigan, for in the latter area the subgenera Phlegmacium and Myxacium predominate. It may also be worth while to point out that the forests and forest floor and the subalpine conditions of this region are very similar to those about Stockholm and Upsala, Sweden. The species of fungi should then also be very similar in both places. With this in mind, it was not surprising to find a large number, especially of the genus Cortinarius, which the writer had collected in that country.

Mr Mains gave special attention to the Uredinales and Ascomycetes, and those groups have been identified largely by him. We here kindly thank Professor Arthur and Mr C. G. Lloyd for courtesies extended in the examination of some of the rusts and Hymenomycetes.

MYXOMYCETES

EXOSPOREAE

Ceratiomyxa fruticulosa (*Muell.*) *Macbr.* On moist decayed wood. Common.

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[1] Plants of North Elba. Charles H. Peck. N. Y. State Mus. Bul. 28, June 1899.

MYXOGASTRES

PHYSARACEAE

Fuligo violacea *Pers.* On bark of decayed pine wood.

Fuligo ovata (*Schaeff.*) *Macbr.* On decayed wood etc.

Physarum contextum *Pers.* On sticks.

Physarum nephroideum *Rost.* On decayed wood.

Physarum sinuosum (*Bull.*) *Weinm.* On fallen twigs.

Craterium leucocephalum (*Pers.*) *Ditt.* On fallen leaves and twigs.

Leocarpus fragilis (*Dick.*) *Rost.* On moss and decayed debris.

DIDYMIACEAE

Didymium eximium *Pk.* On fallen, decaying leaves.

Didymium melanospermum (*Pers.*) *Macbr.* On rotten log.

Didymium nigripes (*Lk.*) *Fr.* On spruce twig.

Diderma crustaceum *Pk.* On fallen and living leaves.

Diderma testaceum (*Schrad.*) *Pers.* On stem of living plant and dead leaves.

Lepidoderma tigrinum (*Schrad.*) *Rost.* On rotten log.

STEMONITACEAE

Stemonitis fusca (*Roth.*) *Rost.* On moss and decayed log.

Comatricha irregularis *Rex.* On rotting bark.

Diachaea leucopoda (*Bull.*) *Rost.* On moss and sticks.

RETICULARIACEAE

Enteridium splendens *Morg.* On decayed log.

TUBIFERACEAE

Tubifera ferruginosa (*Batsch.*) *Macbr.* On variety of substrata of wood.

CRIBRARIACEAE

Dictydium cancellatum (*Batsch.*) *Macbr.* On decayed log.

LYCOGALACEAE

Lycogala epidendrum (*Buxb.*) *Fr.* On decayed wood.

ARCYRIACEAE

Arcyria cinerea (*Bull.*) *Pers.* On decayed wood.

Arcyria denudata (*L*) *Scheld.* On decayed wood.

Arcyria nutans (*Bull.*) *Grev.* On decayed wood.

TRICHIACEAE

Trichia botrytis *Pers.* On decayed wood.

Trichia varia (*Pers.*) *Rost.* Among moss on wood.

ASCOMYCETES

EXOASCACEAE

Exoascus alnitorguus (*Tul.*) *Sadebeck.* On aments of Alnus incana.

GEOGLOSSACEAE

Mitrula irregularis (*Pk.*) *Durand.* In moist ground under conifers. Very distinct.

Microglossum rufum (*Schw.*) *Underwood.* On moist, mossy conifer woods.

Trichoglossum hirsutum (*Pers.*) *Boud.* Among moss in conifer woods.

Geoglossum glabrum *Pers.* In swamps of conifers.

Spathularia clavata *Sacc.* On mossy ground under conifers. S. rugosa Pk. is considered identical.

Spathularia velutipes *Cke. et Farl.* On mossy ground under conifers.

Leotia lubrica *Pers.* On wet moss under conifers.

Leotia stipitata (*Bosc.*) *Schroet.* On mossy ground under conifers.

Cudonia circinans *Fr.* In wet, mossy places under conifers.

Cudonia lutea (*Pk.*) *Sacc.* In spruce and balsam etc. woods, among fallen leaves.

HELVELLACEAE

Helvella crispa *Fr.* On the ground, in mixed woods of spruce, balsam and birch.

Helvella elastica *Pk.* On the ground and decayed wood in mixed woods.

Helvella infula *Schaeff.* On rotten wood and on the ground, in mixed woods.

PEZIZACEAE

Lachnea coprinaria (*Cke.*) *Sacc.* On cow dung. Placed here because of its reddish disk and the spore size, in which it differs from L. stercorea Fr.

Lachnea hemispherica (*Wigg.*) *Gill.* On decayed wood.

Lachnea scutellata *Gill.* On decaying wood.

Plicaria badia *Fuck'l.* On soil and decayed logs.

Plicaria repanda (*Wahl.*) *Rehm.* On rotten wood.

Humaria fusispora (*Berk.*) *Rehm.* On the ground.

Geopyxis cupularis (*L.*) *Sacc.* Among moss on rotten wood.

Macropodia macropus *Fuck'l.* On sandy ground in mixed woods.

Aleuria rutilans (*Fr.*) *Gill.* On mosses in balsam and tamarack swamp. This species has reticulated spores and hence, as pointed out by Seaver (Iowa Discomycetes), belongs to Aleuria and not to Humaria where it is placed by Rehm. The apothecia were about .5 cm in diameter, except a single one which measured 2 cm across. The spores measure 19–26 by 11–14 microns.

Otidea leporina (*Batsch.*) *Fuck'l.* On the ground under spruce and balsam.

ASCOBOLACEAE

Lasiobolus equinus (*Müll.*) *Karst.* On dung edge of clearing.

Ascophanus lacteus *Phill.* On cow dung.

HELOTIACEAE

Chlorosplenium aeruginascens (*Nyl.*) *Karst.* On decorticated wood.

Chlorosplenium aeruginosum (*Oed.*) *De Not.* On dead wood.

Dasychypha agassizii (*B. & C.*) *Sacc.* On the bark of balsam branches.

Dasychypha wilkommii *Hart.* On tamarack twigs.

Helotium citrinum (*Hed.*) *Fr.* On dead wood.

Helotium epiphyllum (*Pers.*) *Fr.* On fallen leaves of poplar.

MOLLISIACEAE

Mollisia cinerea (*Batsch.*) *Karst.* On decayed wood.

Fabraea ranunculi (*Fr.*) *Karst.* On Ranunculus acris. All the spores appeared continuous in this material, hence it could be easily referred to the genus Pseudopeziza.

CENANGIACEAE

Dermatea acericola (*Pk.*) *Rehm.* On bark of dead maple branches.

Tympanis alnea (*Pers.*) *Fr.* On branches of Alnus incana.

Tympanis pinastri *Tul.* On bark of balsam trees. This is probably T. laricina, reported by Peck.

PHACIDIACEAE

Coccomyces coronatus (*Schum.*) *De Not.* On fallen beech leaves.

HYPODERMATACEAE

Lophodermium pinastri (*Schrad.*) *Chev.* On fallen needles of white pine.

HYSTERIACEAE

Glonium lineare (*Fr.*) *De Not.* On birch bark.

Hysterographium mori (*Schw.*) *Rehm.* On decorticated logs.

ERYSIPHACEAE

Microsphaera alni (*D. C.*) *Wint.* On leaves of Viburnum.

Uncinula circinata *Cke. & Pk.* On leaves of maple.

Phyllactinia corylea (*Pers.*) *Karst.* On leaves of alder.

HYPOCREACEAE

Hypomyces aurantius (*Pers.*) *Tul.* On Polystictus versicolor.

Peckiella lateritia (*Fr.*) *Maire.* On species of Russula. Reported by Peck as Hypomyces.

Nectria cinnabarina (*Tul.*) *Fr.* On dead sticks and branches.

Nectria episphaeria (*Tode*) *Fr.* On Ustulina vulgaris. Under the high powers of the microscope the spores of this species are finely warty. This fact seems to have been neglected by authors.

Byssonectria violacea (*Schmidt.*) *Seaver.* On Fuligo ovata. The pale violet perithecia are closely aggregate over the whole surface of the aethalium.

SORDARIACEAE

Podospora amphicornis *Ell.* (sense of Griffiths). On rabbit dung.

SPHAERIACEAE

Lasiosphaeria hispida (*Tode*) *Fuck'l.* On bark of white pine.

Melanomma pulvis-pyrius (*Pers.*) *Fuck'l.* On fallen branches of some deciduous tree.

PLEOSPORACEAE

Leptosphaeria crepini (*Westd.*) *De Not.* On strobili of Lycopodium obscurum var. dendroideum.

DIATRYPACEAE

Diatrype albopruinosa (*Schw.*) *Cke.* On dead maple twigs.

Diatrype platystoma (*Schw.*) *Ell.* On dead maple branches.

Diatrype stigma (*Hoff.*) *De Not.* On dead beech limbs.

Diatrypella betulina *Pk.* On fallen branches of yellow birch.

Diatrypella discoidea *Cke. et Pk.* var. alni Cke. On dead branches of alder.

VALSACEAE

Valsa brevis *Pk.* On bark of fallen balsam branches.

Valsa ceratophora *Tul.* On dead branches of Alnus incana.

MELOGRAMMATACEAE

Valsaria institiva *Ces. et De Not.* On bark of maple.

XYLARIACEAE

Ustulina vulgaris *Tul.* On much decayed logs.

Hypoxylon coccineum *Bull.* On bark of beech.

Hypoxylon effusum *Nke.* On rotten logs.

Hypoxylon fuscum (*Pers.*) *Fr.* On branches of Alnus incana.

Hypoxylon multiforme *Fr.* On bark and branches of yellow birch.

Hypoxylon rubiginosum (*Pers.*) *Fr.* On decaying logs.

Xylaria corniformis *Fr.* On rotten logs.

Xylaria digitata *Grev.* On pine logs. Also var. americana Pk.

FUNGI IMPERFECTI

Phyllosticta saccharina *Ell. et Mont.* On leaves of Acer pennsylvanicum.

Cytospora horrida (*Sacc.*) On dead branches of birch.

Sphaeronemella helvellae *Karst.* On stipe of Helvella infula.

Discosia artocreas (*Tode*) *Fr.* On leaves of poplar.

Stysanus berkeleyi (*Mont.*) *Sacc.* On pore surface of Fomes pinicola.

Polythrincium trifolli *Kze.* On leaves of Trifolium repens.

Cercospora circumscissa *Sacc.* On leaves of Prunus.

Pestalozzia funerea *Desm.* On dead leaves of living arbor vitae tree.

UREDINALES

MELAMPSORACEAE

Chrysomyxa chiogenis *Diet.* On Chiogenes hispidula Only the uredospore stage was found.

Chrysomyxa ledi (*Alb. et Schw.*) *De Bary.* On Ledum groenlandicum. Uredospore stage.

Coleosporium solidaginis (*Schw.*) *Thüm.* On aster. Uredospore stage.

Melampsora biglowii *Thüm.* On leaves of willow. Uredospore stage.

Melampsora medusae *Thüm.* On leaves of Populus tremuloides. Uredospore and Telentospore stage.

Melampsoridium betulae (*Schw.*) *Arth.* On leaves of Ostrya. Uredospore stage.

Pucciniastrum pustulatum (*Pers.*) *Dict.* On leaves of Epilobium angustifolium. Telentospore stage.

Uredinopsis osmundae *Magn.* On Osmunda cinnamomea. Uredospore stage.

Melampsorella caryophyllacearum *Schroet.* Aecidial stage. (Peridermium elatinum K. & S.) abundant on the needles of " witches brooms " which it causes on the balsam fir.

PUCCINIACEAE

Puccinia angustata *Pk.* On Scirpus cyperinus var. pelius. Telentospore stage. On the leaves and leaf-sheaths. *Fide* Arthur.

Puccinia asteris *Duby.* On leaves of asters. Telentospore stage.

Puccinia circaeae *Pers.* On Circaea alpina. Telentospore stage. On the leaves.

Puccinia perminuta *Arth.* On Cinna arundinacea. Telentospore stage. *Fide* Arthur.

Puccinia spreta *Pk.* On Mitella nuda. Telentospore stage.

Puccinia uniporula *Orton.* On Carex arctata and debilis var. rudgei. Telentaspore stage. *Fide* Arthur.

Puccinia urticae (*Schw.*) *Lagerh.* On Carex crinita. Telentospore stage. *Fide* Arthur.

Puccinia violae *D.C.* On leaves of violet. Telentospore stage.

Phragmidium albidum *Lagerh.* On leaves of Rubus. Uredospore stage.

TREMELLALES

Hirneola auricula-judae *Berk.* On decaying wood of spruce and balsam.

Pilacre Petersii *B. & C.* On decorticated wood of a prostrate pine tree.

Tremellodon gelatinosum *Fr.* On wet and rotten wood.

Exidia glandulosa *Fr.* On dead branches and sticks of beech, Alnus and other deciduous trees.

Tremella sp. Parasitic on Aleurodiscus amorphus. Except in color, which is whitish, it seems close to T. versicolor Pk.

Tremella mycetophila *Pk.* Parasitic on Collybia dryophila.

Naematelia encephala *Fr.* On decayed wood.

Dacryomyces deliquescens *Fr.* On decayed wood.

Dacryomyces corticoides *E. & E.* On sticks.

Calocera viscosa *Fr.* On the ground under conifers.

THELEPHORACEAE

Thelephora anthocephala *Fr.* On the ground among conifer needles.

Thelephora laciniata *Fr.* Growing interwoven with debris of sticks, conifer needles and humus.

Thelephora palmata *Fr.* On the ground, under balsam and spruce. Known by its strong fetid odor.

Thelephora terrestris *Fr.* Forming large, expanded masses on moss and humus.

Stereum sanguinolentum *Fr.* Resupinate, on spruce logs, bleeding where bruised if fresh, the wounds turning blackish. The resupinate habit, its host, and its testure separate it from S. spadiceum.

Stereum tuberculosum *Fr.* On spruce and hemlock logs and stumps.

Stereum curtisii *Berk.* On dead maple branches.

Hymenochaete avellana *Fr.* On dead branches of maple and other deciduous trees.

Hymenochaete cinnamomea *Fr.* On birch bark.

Hymenochaete ferruginosa *Fr.* On log of deciduous tree.

Hymenochaete tabacina *Fr.* On dead branches of deciduous tree.

Hymenochaete rubiginosa. On sticks.

Peniophora incarnata *Fr.* On dead alder branches.

Peniophora cinerea *Fr.* On maple twigs.

Coniophora puteana *Fr.* On bark of decayed hemlock wood.

Aleurodiscus amorphus *Fr.* On dead branches of the balsam fir; abundant.

HYDNACEAE

Irpex tulipifera *Schw.* On dead branches of Prunus serotina.

Hydnum caput-ursi *Fr.* On trunks and logs of beech.

Hydnum coralloides *Fr.* On beech logs. This species is much more branched than the preceding, but seems to run into it.

Hydnum cyathiforme (*Schaeff.*) *Fr.* Among moss and twigs under conifers.

Hydnum laciniatum *Leers.* On a prostrate beech trunk. The very fine branching is a striking character.

Hydnum repandum *Fr.* On the ground under balsam etc.

Hydnum scrobiculatum *Fr.* On the ground, under conifers.

Hydnum septentrionale *Fr.* On living maple trunks.

Asterodon ferruginosum *Pat.* On much decayed conifer logs. This is referred to by Peck in the North Elba report as A. setiger Pk. He originally named it Hydnochaete setigera Pk. It occurs also in northern Michigan.

Phlebia centrifuga *Karst.* On decaying sticks, probably of spruce.

Phlebia merismoides *Fr.* On coniferous wood.

Phlebia radiata *Fr.* On beech log.

Phlebia strigoso-zonata *Schw.* On wood of Prunus serotina.

Hypochnus vaga *Fr.* On decayed wood of yellow birch. This seems to have a number of synonyms. It was found frequently. When sterile it is bounded by radiating orange-yellow strands, while the developing hymenium becomes a gray-drab color. It was probably referred by Peck to Phlebia vaga.

Grandinia crustosa *Fr.* On decayed wood of balsam. Spores oval, hyaline, 5–6 by 4–5 microns.

Grandinia granulosa *Fr.* On decayed conifer log. The hyphae are dichotomously branched forming irregularly stellate pieces, when crushed under the microscope.

POLYPORACEAE

Boletinus cavipes. On sphagnum and other mosses, under white pine and balsam trees.

Boletinus pictus *Pk.* In conifer woods, especially hemlock.

Boletus chrysenteron *Fr.* In open poplar woods, hillsides.

Boletus clintonianus *Pk.* On sphagnum and other mosses, under spruce and tamarack.

Boletus elbensis *Pk.* On sphagnum and other mosses, under spruce and tamarack. Certainly a distinct species.

Boletus rubritubifer *sp. nov.*

Pileus 2–5 cm broad, fleshy, convex, obtuse, glabrous or obscurely substomentose, dry, even, cinnamonrufous (Ridg.), slightly

variegated with yellowish. Flesh whitish tinged yellow, unchanged, very thick. Tubes pompeian red (Ridg.) throughout; mouths red, depressed around the stem, convex, 5–8 mm long, mouths subangular, 2 to a mm, dissepiments rather thick. Stem 5–6 cm long, 1–2 cm thick above, tapering downward, dingy apricot yellow (Ridg.), concolor within, even, glabrous, solid. Odor and taste mild. Spores subfusiform — cylindrical, hyaline or faintly reddish brown under microscope, 9–12 by 4 μ. On the ground under spruce trees, North Elba, September 10.

Strongly marked by the color of the tube layer which is dark red throughout.

Boletus granulatus *Fr.* On moss, under spruce and pine.

Boletus scaber *Fr.* The specimens are referable to var. alutaceus. Under balsam and spruce.

Boletus subtomentosus *Fr.* On the margin of conifer woods.

Boletus versipelles *Fr.* In mixed woods.

Fomes applanatus *Fr.* On logs and dead trunks of deciduous trees.

Fomes carneus *Nees.* On spruce logs. Usually thinner and more applanate than F. roseus.

Fomes connatus *Fr.* On dead birch wood.

Fomes fomentarius *Fr.* On trunks of living and dead birch trees.

Fomes fraxinophilus *Pk.* On trunk of willow. This is a very unusual host, as this species is almost exclusively found on ash. The young pileus was entirely whitish over the surface and had a distinct fragrant odor.

Fomes igniarius *Fr.* Frequent on standing beech trunks where the fruit bodies become very large. We also found it on a red maple.

Fomes nigricans *Fr.* On trunks of white and yellow birch where it is not infrequent. Known from the preceding by its smoother pileus and different shade of color; the incrustation of the surface of the pileus is very thin.

Fomes pinicola *Fr.* On coniferous wood. Not frequent around Newmans, where hemlock trees are lacking.

Fomes roseus *Fr.* On decaying logs of pine and spruce.

Fomes scutellatus *Schw.* On dead trunks and branches of alder.

Polyporus adustus *Fr.* On dead wood of poplar and other deciduous trees.

Polyporus betulinus *Fr.* On birch; found only on fallen limbs. Rare in this locality.

Polyporus benzoinus *Fr.* On conifer logs.

Polyporus chioneus *Fr.* Common on birch logs and on fallen or dead limbs. P. albellus Pk. is considered the same by some authors. Lloyd says it is not the true P. chioneus of Fries.

Polyporus circinatus *Fr.* Under spruce and balsam, on the ground; sometimes intergrown with Lycopodium among which it may be growing. The pileus is rarely 15 cm broad, more commonly smaller.

Polyporus elegans *Fr.* On decaying logs.

Polyporus galactinus *Berk.* On logs and fallen branches of spruce and on sticks of other wood. This was at first thought to be P. borealis, but that species was not discovered in this locality.

Polyporus gilvus *Fr.* On an alder trunk.

Polyporus glomeratus *Pk.* On log of some deciduous tree. The greenish color when fresh is distinctive. It is at first resupinate and widely spread and when dry may be passed over as a young P. adustus; the greenish color disappears.

Polyporus guttulatus *Pk.* On some conifer logs and a white pine stump.

Polyporus intybaceus *Fr.* On stump of tamarack tree. The spores measure 5–6 by 2–3 microns. The specimen had only three pileoli, each 3–5 inches broad, on an extended, connate stipe about 5 inches long. According to Saccardo it is normally very much branched with numerous pilei.

Polyporus nidulans *Fr.* On wood, probably maple. Infrequent.

Polyporus picipes *Fr.* Common on decaying logs.

Polyporus pubescens *Fr.* Common on birch, willow, alder etc.

Polyporus radiatus *Fr.* On birch; frequent. The pore surface of the fresh plant is mostly smoky gray (Ridg.). Pileus sometimes with a golden yellow margin. P. aureonitens Pat. et Pk. is probably the same, as the colors vary considerably even on the same branch.

Polyporus schweinitzii *Fr.* On white pine and spruce logs and stumps. Frequent.

Polyporus spumeus *Fr.* On ash logs. This white species is reduced to a small size when dried and then becomes dingy yellowish brown.

Polyporus sulphurens *Fr.* On trunks and logs of deciduous trees.

Polyporus weinmanni *Fr.* On decaying conifer logs.

Polystictus hirsutus *Fr.* On dead wood of deciduous trees.

Polystictus perennis *Fr.* In open ground or clearings.

Polystictus velutinus *Fr.* On dead beech limbs. Much like P. pubescens, but thinner, more zonate, not so radiately

wrinkled or so markedly imbricate. It is sometimes subresupinate or reflexed.

Polystictus versicolor *Fr.* On birch and wood of deciduous trees.

Poria attenuata *Pk.* On poplar wood.

Poria betulina (*Murr.*) This is Fomitiporella betulina Murr. of the N. A. F. It was probably referred by Peck to Fomes salicinus Fr. It is frequent on birch. It has much the appearance of Poria inermis.

Poria cinerea *Schw.* On the bark of spruce logs.

Poria ferruginosa *Fr.* On fallen branches of spruce.

Poria medulae-panis *Fr.* On decaying logs of birch and beech.

Poria nitida *Fr.* On wood of some deciduous tree.

Poria prunicola (*Murr.*). This is Fomitiporia prunicola Murr. of the N.A.F. It forms extensive patches on trunks and branches of Prunus serotina.

Poria semitincta *Pk.* On conifer log.

Poria tenuis *Schw.* On decayed wood.

Poria rufa *Schroet.* On fallen trunks of spruce where it forms extensive patches. Hymenium is ochraceous — salmon color to mahogany-red (Ridg.), and of a sticky gelatinous nature when fresh; context pure white; adnate, sometimes slightly reflexed. It was referred here by C. G. Lloyd.

Trametes cinnabarina *Fr.* On dead wood of deciduous trees.

Trametes mollis *Fr.* On conifer logs. This is said to be T. cervinus Pers. It becomes smoky-cinereous in age.

Trametes Pini *Fr.* On spruce logs, often forming extensive resupinate-reflexed sheets. This is the form referred by Peck to T. abietis.

Trametes serialis *Fr.* On under side of conifer logs.

Trametes variiformis *Pk.* On fallen trunk of white pine.

Daedalea confragosa *Fr.* On wood of deciduous trees especially white birch of the locality.

Daedalea unicolor *Fr.* On birch etc. The surface of the fresh pileus is often very pale.

Favolus europaeus *Fr.* Common on dead limbs and fallen branches, sticks etc. F. canadensis seems to be a synonym.

Merulius pulverulentus *Fr.* On decayed wood. The reticulations are composed of grayish white, thick, convolute ridges.

Merulius subaurantiacus *Pk.* On dead wood of the balsam fir.

Merulius tremulosus *Fr.* On birch bark of dead wood.

Lenzites betulina *Fr.* On decayed wood of deciduous trees.

Lenzites sepiaria *Fr.* On dead wood of conifers, often where charred by fire.

Solenia anomola *Fr.* On dead twigs of yellow birch.

CLAVARIACEAE

Clavaria apiculata *Fr.* On decayed wood. These plants were calla-green (Ridg.) toward base, to pale greenish yellow at tips. Spores 9 by 4 microns, yellowish.

Clavaria asperula *Atk.* Under spruce and birch trees, on humus.

Clavaria canaliculata *Fr.* In cedar swamp, among moss and grass.

Clavaria cinerea *Fr.* On humus and mu.h decayed wood, under balsam and pine. The basidia are 2-spored.

Clavaria cristata *Fr.* On the ground in conifer forests. Form *minor,* in sense of Patouillard, also occurs.

Clavaria corrugata *Karst.* On the ground under conifers. Spores 8–9 by 3 microns, slightly yellowish. This has the habit of C. muscoides, but spores are elliptical.

Clavaria flaccida *Fr.* Under conifers, on the ground.

Clavaria flava *Fr.* The form found, growing among conifer needles, may be referred to as forma *carnicolor,* because of its pale flesh color. The habit and spores are those of the species of frondose woods.

Clavaria inequalis *Fr.* Under conifers. This is probably the form C. aurantiaca Pers. The specimens were golden yellow, sometimes with a longitudinal furrow on the sides.

Clavaria ligula *Fr.* Growing on beds of spruce needles.

Clavaria muscoides *Fr.* On mosses, in spruce and balsam forests.

Clavaria platyclada *Pk.* In conifer or mixed woods. This seems to be a form of C. fusiformis Fr.

Clavaria rugosa *Fr.* On black soil of cedar swamp.

Clavaria stricta *Fr.* On logs of beech, etc.

Typhula filicina *Pk.* On stipes and fronds of dead plants of Pteris aquilina. Spores 8–10 by 4–5 microns. Sclerotia pale to white, covered by epidermis of host. Stipe often brownish at base. This is apparently Peck's species, although the sclerotia were not exposed.

Physalacria inflata *Pk.* On rotten log.

AGARICACEAE

LEUCOSPORAE

Amanita flavoconia *Atk.* Under balsam among mosses. A distinct species and easily separated from A. frostiana Pk. by the pulverulent volva. The latter species was not seen at this time.

Amanita muscaria *Fr.* Stems deeply imbedded in Polytrichum moss, under conifers.

Amanita tomentella *Kromb.* Solitary or scattered in conifer woods. Frequent during the month, apparently autumnal. The spores are spherical.

Amanitopsis strangulata *Fr.* Under conifers, balsam and spruce. Its pileus is covered with superficial, mouse-gray scales.

Amanitopsis vaginata *Roze.* On moss and bare ground, mixed woods.

Lepiota acutesquamosa *Fr.* Under conifers. Found but once.

Lepiota amianthina *Fr.* On mosses under balsam, spruce and pine. The colors are duller than given for the European plant, more like those of L. granulosa. The pileus is scarcely ever umbonate and hence approaches L. adnatifolia Pk. The gills are narrowly adnate.

Lepiota cinnabarina *Fr.* In mixed woods of birch and conifers.

Lepiota clypeolaria *Fr.* Under balsam and spruce among debris and humus. The creamy-white variety.

Lepiota cristata *A. & S.* In a hardwood forest.

Lepiota friesii *Lasch.* In mixed woods of birch, beech and spruce. Known by the abundantly forked gills.

Lepiota granosa *Morg.* On prostrate, decaying trunks of deciduous trees. Very distinct from related species.

Lepiota granulosa *Fr.* On mossy ground under conifers.

Lepiota illinita *Fr.* In mixed woods of pine, spruce and birch.

Lepiota procera *Fr.* In a clearing on top of a wooded hill.

Lepiota pulveracea *Pk.* Under balsam in wet swamp. A pale form with creamy-white pileus, adnexed gills and stem squamulose up to the annulus.

Tricholoma flavescens *Pk.* On decayed wood, in a balsam and spruce swamp.

Tricholoma fumosoluteum *Pk.* Among mosses under tamarack and balsam trees.

Tricholoma imbricatum *Fr.* Under conifers. Separated from T. vaccinum by its solid stem.

Tricholoma naucoria *Murr.* On beds of conifer needles. This is T. fallax Pk. Its new specific name is well chosen.

Tricholoma personatum *Fr.* On the ground under leaves. Very infrequent.

Tricholoma resplendens *Fr.* Under hardwood trees.

Tricholoma rutilans *Fr.* On decaying stumps and logs.

Tricholoma subacutum *Pk.* Under conifers, frequent. Its spores measure 6–7 by 4 microns., somewhat smaller than those of the European T. virgatum. The color of the pileus is pearl-gray (Ridg.). It is also closely related to T. acre Pk. and T. murinaceum Bull.

Tricholoma submaculatum *Pk.* On mossy ground under conifers. The stem is subventricose, slightly rooting, usually decumbent. The gills stain yellow.

Tricholoma subrufescens *E. & E.* Under conifers. The plants vary in having shorter stems. This species approaches T. inodermeum Fr., but the gills are close and not broad. It has the habit of a large Inocybe. Color of pileus and stem is clay to cinnamon-buff. (Ridg.). Spores small, subspheroid.

Tricholoma transmutans *Pk.* Under conifers.

Tricholoma viriditinctum *Pk.* Under spruce and balsam. This is the T. virescens of the North Elba Report.

Clitocybe anisearia *Pk.* Among forest debris and humus. Probably to be considered a variety of C. odora Fr. with narrow, crowded gills. Sometimes no green color is present.

Clitocybe candicans *Fr.* In balsam swamp. The satiny, shining-white pileus is characteristic.

Clitocybe clavipes *Fr.* In mixed woods.

Clitocybe cyathiformis *Fr.* On prostrate trunks of white pine, etc.

Clitocybe decora *Fr.* On decaying spruce logs, etc.

Clitocybe diatreta *Fr.* On deep moss, balsam and spruce swamp. The narrow, crowded gills are Tileul-buff (Ridg.) in color.

Clitocybe ditopoda *Fr.* In mixed woods among fallen leaves.

Clitocybe ectypoides *Pk.* On decaying mossy conifer logs.

Clitocybe gilva *Fr.* Under balsam trees, etc., in low ground, deep in the moss. This seems to be a subalpine species which I have not seen elsewhere.

Clitocybe infundibuliformis *Fr.* In mixed woods of birch, beech, and spruce.

Clitocybe laccata *Fr.* Common in low swampy woods, etc.

Clitocybe media *Pk.* Under conifers. Variable and approaching C. clavipes in the shape of the stem.

Clitocybe multiceps *Pk.* On the ground in mixed woods. Much less caespitose than usual in open grassy places.

Clitocybe nebularis *Fr.* In mixed woods.

Clitocybe piceina *Pk.* Under conifers and birch. A toughish plant with gills decurrent on the stem in raised lines.

Clitocybe robusta *Pk.* In mixed woods of birch, beech and spruce. The gills are vinaceous-buff (Ridg.) when fresh, becoming army-brown (Ridg.) after being dried. The pileus varies from the thick and firm condition of the type.

Clitocybe sinopica *Fr.* On charred soil in woods.

Collybia albiflavida (*Pk.*). On the ground among decaying forest debris. The character of the stem-cortex is more like Collybia than Tricholoma.

Collybia butyracea *Fr.* Under cedar, balsam and pine. The typical form.

Collybia confluens *Fr.* Among fallen leaves.

Collybia distorta *Fr.* Subcaespitose on conifer stump. The distinguishing characters are the narrow, crowded gills which soon become rufescent-spotted, the compressed subsulcate stem and the chestnut-brown pileus soon fading to cinnamon. Spores 3–4 by 2 microns. Cystidia none.

Collybia dryophila *Fr.* Under white pine and spruce. A variety occurs with stem colored Mars-yellow (Ridg.).

Collybia familia *Pk.* On mossy logs, cedar and hemlock swamps.

Collybia maculata *A. & S.* Under pine and balsam.

Collybia stridula *Fr.* Low ground under conifers.

Collybia stipitaria *Fr.* On needles of spruce.

Collybia succosa *Pk.* On decaying wood.

Collybia tuberosa *Fr.* On decayed debris including fungous remains.

Mycena clavicularis *Fr.* On beds of pine needles.

Mycena epipterygia *Fr.* On mossy logs.

Mycena galericulata *Fr.* On decayed wood in cedar swamp. Not noticed elsewhere.

Mycena haematopoda *Fr.* On mossy logs of cedar etc.

Mycena immaculata *Pk.* On mosses and humus.

Mycena leaiana *Berk.* On rotten wood.

Mycena pelianthina *Fr.* In mixed woods of beech and spruce, etc.

Mycena pura *Fr.* Among debris in mixed or conifer woods.

Mycena rorida *Fr.* var. On and among pine and spruce needles. These plants depart from the species in the gills being broadly adnate but not decurrent and in the spore size. The spores are elliptic-ovate, 7–9 by 4–5 microns. According to Ricken, the size of the spores are 10–15 by 4–5, cylindric-lanceolate.

Mycena rubromarginata *Fr.* var. Among forest debris under balsam trees. The specimens found were smaller than the typical form and the edge of the gills were fuscous-brown with scarcely a red

tinge. It differs from M. denticulata Pk. and M. purpureofusca Pk. in its large spores which measure 10–12 by 6–7 microns.

Mycena vitilis *Fr.* On moss and black soil in springy places in a cedar swamp. A long-stemmed elegant little species.

Mycena vulgaris *Fr.* In mixed woods among fallen leaves and conifer needles.

Omphalia albidula *Pk.* On debris, under balsam.

Omphalia austini *Pk.* On stump of Arbor vitae. This is a small white species with viscid pileus.

Omphalia campanella *Fr.* On decayed wood of conifers.

Omphalia chrysophylla *Fr.* On decaying prostrate conifer trunks. Somewhat of the habit and colors of Clitocybe decora, but smaller, with more slender cartilaginous stem and spores measuring 10–11 by 4–5 microns.

Omphalia demissa *Fr.— Bres.* In balsam and spruce swamp. Distinguished among the small species by the large spores, 10–12 by 6–7 microns. The colors are paler than in the typical form, without any purplish tints.

Omphalia fibula *Fr.* On and among mosses.

Omphalia umbellifera *Fr.* On decayed wood.

Pleurotus albolanatus (*Pk.*). (See Agaricaceae of Michigan.) On much decayed birch logs. Separable from P. porrigens by the spherical spores and the differentiated upper layer of the pileus. From Panus angustatus it is separated by the lack of cystidia.

Pleurotus applicatus *Fr.* On rotten wood of conifer forests.

Pleurotus circinatus *Fr.* On decayed logs in spruce woods.

Pleurotus lignatilis *Fr.* On dead wood of deciduous trees.

Pleurotus mitis *Fr.* On sticks and debris in woods.

Pleurotus porrigens *Fr.* On decayed conifer logs and stumps The margin of the pileus is persistently inrolled.

Pleurotus sapidus *Fr.* On dead trunks and logs.

Pleurotus serotinus *Fr.* On mossy logs in mixed woods.

Pleurotus sulfuroides *Pk.* On conifer logs.

Pleurotus ulmarius *Fr.* On living maple trunks; associated with Panus strigosus B. & C. in one case.

Hygrophorus borealis *Pk.* On moist ground, mixed woods.

Hygrophorus capreolarius *Kalchb.* Under balsam and spruce in and among mosses in which the young plants are often completely sunk. On sphagnum the stems attain a length of 8–10 cm.

Hygrophorus ceraceus *Fr.* On the ground under balsam.

Hygrophorus chlorophanus *Fr.* Low ground in woods.

Hygrophorus conicus *Fr.* Among moss in cedar swamp.

Hygrophorus fuscoalbus *Fr.* Under cedar trees. The typical form.

Hygrophorus miniatus *Fr.* In moist places, swamps; also H. cantherellus Schw., which I consider only a variety.

Hygrophorus peckii *Atk.* On mossy ground, under balsam and spruce.

Hygrophorus pudorinus *Fr.* On mossy ground and among needles of balsam and spruce. This seems to have been referred to H. queletii Bres. by Peck in the North Elba Report. (See also Rep't 42.) But the large size and the coloration are those of H. pudorinus. The subviscid, separable pellicle seems to belong to both species. Ricken says it occurs exclusively in beech forests, but in Michigan this same species occurs also under hemlocks.

Hygrophorus puniceus *Fr.* In mixed woods of birch and spruce.

Hygrophorus speciosus *Pk.* On sphagnum in cedar and tamarack swamp. This seems to be the American form of H. aureus Fr. Two color forms occurred in the same locality: the typical form with the orange-vermilion pileus, and a form with pileus distinctly different in color, that is, light cadmium (Ridg.) in the young as well as in the old stages. The typical form had all the characters of the plant common in the sphagnum bogs of Michigan.

Lactarius affinis *Fr.* In mixed woods of birch and spruce.

Lactarius camphoratus *Fr.* Under balsam and cedar in swamps.

Lactarius cinereus. On much decayed wood in coniferous forests.

Lactarius circellatus *Fr.* In mixed open woods.

Lactarius deceptivus *Pk.* In mixed woods.

Lactarius deliciosus *Fr.* Under balsam and tamarack in swamp.

Lactarius fuliginosus *Fr.* Under spruce.

Lactarius griseus *Pk.* On decayed wood among moss.

Lactarius helvus *Fr.* On moss, conifer swamps.

Lactarius hysginus *Fr.* On wet ground under conifers.

Lactarius lignyotus *Fr.* Under balsam and spruce.

Lactarius oculatus *(Pk.) Burling.* On the ground under conifers.

Lactarius pyrogalus *Fr.* In open woods, hillside.

Lactarius rufus *Fr.* Among moss under balsam.

Lactarius subdulcis *Fr.* In moist woods and swamps.

Lactarius theiogalus *Fr.* Under balsam and spruce.

Lactarius torminosus *Fr.* Under conifers.

Lactarius trivialis *Fr.* Under balsam, birch etc.

Lactarius turpis *Fr.* In low ground under conifers. Common; gregarious or subcespitose. This is L. sordidus Pk., but seems too close to the European plant.

Lactarius uvidus *Fr.* In low swampy ground under cedar and balsam.

Russula adusta *Fr.* Under spruce and pine. A single specimen.

Russula delica *Fr.* In sandy soil, under conifers.

Russula emetica *Fr.* Among needles of balsam and spruce in swamps. A form with gills more crowded than is usual in the Michigan plants.

Russula fallax *Cke.* In wet swamps of cedar etc. on sphagnum.

Russula flava *Romell.* In conifer woods.

Russula foetens *Fr.* On the ground in woods.

Russula fragilis *Fr.* In swamps of conifer trees.

Russula paludosa *Britz.* Low ground under conifers. One of the largest Russulae, the stem sometimes attaining a length of 20 cm. It is frequent in similar habitats in Sweden, where Lindblad named it R. elatior.

Russula purpurina *Q. & S.* In cedar swamps.

Russula turci *Bres.* Under balsam trees. The gills are bright ochraceous-yellowish at maturity. The pileus is smoky-brownish with violaceous, greenish or purplish tints with a blackish disk. Taste is mild.

Russula xerampelina *Fr.* In conifer woods.

Cantherellus cibarius *Fr.* Under conifers.

Cantherellus infundibuliformis *Fr.* Among moss in tamarack and spruce swamp.

Cantherellus umbonatus *Fr.* On deep sphagnum and other mosses.

Marasmius androsaceus *Fr.* On fallen balsam needles, twigs etc.

Marasmius capillaris *Morg.* On fallen beech leaves.

Marasmius cohaerens *Fr.* On rotten wood in mixed forests.

Marasmius oreades *Fr.* Roadsides and pastures.

Marasmius prasiosmus *Fr.* On beds of spruce and balsam.

Marasmius rotula *Fr.* On dead wood, roots and stumps.

Marasmius siccus *Schw.* On the ground among fallen leaves in mixed woods of beech, birch and spruce.

Lentinus lepideus *Fr.* On decaying wood of conifers.

Panus stipticus *Fr.* On dead branches of alder etc.

Panus strigosus *B. & C.* On living maple trunks, in one case in company with Pleurotus ulmarius, both growing from the

same wound about 8 feet from the ground. Some refer it to P. laevis B. & C.

Panus rudis *Fr.* On stumps of deciduous trees, usually reported as Lentinus lecontei.

RHODOSPORAE

Pluteus admirabilis *Pk.* On mossy logs in woods.

Pluteus cervinus *Fr.* On stumps of birch etc.

Pluteus granularis *Pk.* On logs in conifer woods.

Pluteus longistriatus *Pk.* On decayed log.

Entoloma griseum *Pk.* Among moss under balsam trees.

Entoloma cyaneum *Pk.* In mixed woods of pine, spruce and birch. The vinaceous color of the typical plant was almost entirely lacking, but the other characters were normal.

Entoloma rhodopolium *Fr.* In open woods of spruce, hillsides.

Entoloma salmoneum *Pk.* On moss and ground in conifer woods.

Entoloma sericatum *Britz.* In mixed woods. This species has the habit and size of E. rhodopolium, but differs in possessing a distinct farinaceous odor and in the narrow gills. The gills are never cinereous. (See Agaricaceae of Michigan.)

Entoloma strictius *Pk.* In swamps, often about base of stumps.

Clitopilus albogriseus *Pk.* In mixed woods.

Clitopilus woodianus *Pk.* In a cedar and birch swamp.

Leptonia asprella *Fr.* In moist places, cedar and birch swamp.

Leptonia formosa *Fr.* Under pine in mosses.

Leptonia grisea *Pk.* In moist places, cedar swamp.

Leptonia lampropoda *Fr.* On mosses under balsam and spruce.

Nolanea conica *Pk.* Among mosses in conifer swamps.

Nolanea fuscogrisellus *Pk.* On mosses under conifers.

Nolanea mammosa *Fr.* In cedar swamp.

Eccilia mordax *Atk.* In frondose woods.

Claudopus nidulans *Fr.* On decayed wood, in birch, beech and spruce forest.

OCHROSPORAE

Paxillus involutus *Fr.* In conifer woods.

Paxillus rhodoxanthus *Schw.* On the ground in open conifer hillsides.

Pholiota adiposa *Fr.* On living beech trunk.

Pholiota aggericola *Pk.* Among debris on the ground in mixed woods. This was formerly called P. indecens and P. aggerata. Pk.

Pholiota caperata *Fr.* Under balsam and spruce.

Pholiota confragosa *Fr.* On decayed logs.

Pholiota limonella *Pk.* On and around the base of yellow birch trunks.

Pholiota marginata *Fr.* On rotten wood.

Pholiota spectabilis *Fr.* On trunk of living yellow birch tree.

Pholiota squarrosoides *Pk.* On trunk of living maple tree.

Pholiota lutea *Pk.* On decaying beech log. Caespitose. It differs from P. spectabilis in its darker mature gills which are chestnut-bay color (Ridg.). The stems become fuscous-ferruginous and are clavate at base. Gills narrow. Flesh etc. yellow. The pileus and stem are not squamose nor distinctly viscid and in this respect differ from P. aurivella Fr. and P. limonella Pk. which are also said to grow on beech. Spores 7–8 by 5–5½ micr.

Hebeloma firmum *Fr.* Under spruce. Spores 10–12 by 5–6 micr.

Hebeloma longicaudum *Fr.* On sphagnum, under balsam and spruce.

Inocybe calamistrata *Fr.* In deep moss under balsam trees.

Inocybe cookei *Bres.* Under balsam trees etc.

Inocybe excoriata *Pk.* In mixed woods.

Inocybe geophylla *Fr.* In cedar swamps etc. on moss.

Inocybe infelix *Pk.* In open places, roadsides etc.

Inocybe nodulospora *Pk.* Under spruce and balsam trees.

Spores 7–11 by 6–7 micr. and therefore smaller than those of I. lanuginosa (Fr.) Bres. which are said to measure 11–15 by 8–9 micr.

Inocybe subochracea *Burt.* In moist places in woods.

Inocybe umboninota *Pk.* In woods.

Inocybe violacea *Fr.* On the ground under conifer trees. Always distinct and constant.

Flammula alnicola *Fr.* On decayed wood, in swamps.

Flammula mixta *Fr.* Among mosses on the ground, under conifers. Known by its large spores, measuring 10–13 by 6–7 micr.

Flammula sapinea *Fr.* On decayed spruce logs.

Flammula spumosa *Fr.* On sticks etc. in swamps.

Naucoria semiorbicularis *Fr.* Roadsides and fields.

Naucoria temulenta *Fr.* On black soil in conifer swamps.

Galera hypnorum *Fr.* On mosses.

Galera sphagnorum *Fr.* On sphagnum.

Crepidotus versutus *Fr.* On decayed wood.

Cortinarius alboviolaceus *Fr.* Among debris of forests, under conifers and birch.

Cortinarius alutaceofulvus *Britz.* On wet, mossy ground in mixed woods. This is a segregate of C. bivelus Fr. from which it differs by its spheroid spores which measure 6–6½ by 5–6 microns.

Cortinarius anomalus *Fr.* On the ground in hemlock woods.

Cortinarius annulatus *Pk.* In mixed woods of spruce and birch.

Cortinarius armeniacus *Fr.* Among moss under spruce etc.

Cortinarius armillatus *Fr.* In hemlock and beech woods.

Cortinarius catskillensis *Pk.* Under hemlock and beech.

Cortinarius chrysolitus *sp. nov.*

Pileus 1.5–4 cm broad, convex then plane, light brownish olive to buffy citrine (Ridg.), unicolorous, densely innately fibrillose-hairy, even, opaque, margin at first incurved then decurved. Flesh concolor, thin on margin. Gills at first chrysolite green (Ridg.), then yellowish cinnamon, adnate, emarginate, rather broad, close, thickish, entire on edge. Stem 7–10 cm long, 3–5 mm thick, slender, equal, stuffed then hollow, brownish olive, concolor within, fibrillose, mycelioid at base and attached to sphagnum. Cortina olivaceous. Spores oval-elliptical, 8–9 by 5–6 microns; roughish. Odor slight, not of radish. Taste mild.

On deep sphagnum in swamp of balsam trees. The species belongs to the subgenus Dermocybe. It is related to C. raphanoides Fr. but differs in habitat, more slender habit, and lacks the odor and taste of that species. The colors become rather darker as the plant loses moisture.

Cortinarius cinnamomeus *Fr.* In swamps of cedar, balsam etc. on mosses. A number of its varieties also occurred.

Cortinarius claricolor *Fr.* Among fallen needles of spruce and pine. The color of the pileus is raw-sienna to orange-buff (Ridg.). The stem is while silky-fibrillose at first but not at all ringed as in C. triumphans *Fr.*

Cortinarius cylindripes *Kauff.* In balsam swamp.

Cortinarius deceptivus *Kauff.* Among debris in conifer woods. The violet to lavender color of the young plant is much deeper than in C. anomalus and fades rapidly.

Cortinarius decipiens *Fr.* Among mosses and sphagnum in balsam and tamarack swamp. A slender plant whose pileus possesses a prominent blackish umbo. The gills soon become Mars-yellow (Ridg.). A variety *minor* occurs.

Cortinarius erugatus *Fr.* Under conifers.

Cortinarius erythrinus *Fr.* Under balsam trees on bare soil. Smaller than C. decipiens, with violaceous hues at the apex of the slender stem.

Cortinarius evernius *Fr.* In tamarack and spruce swamp. The stems are often deeply embedded in mosses and may become 15–20 cm long; when fresh they are colored a brilliant lavender-violet, especially toward the base.

Cortinarius flexipes *Fr. minor.* In mosses under spruce trees. One of the prettiest. The pileus is densely covered by grayish white, subagglutinate, fibrillose scales up to the acute umbo.

Cortinarius glabellus *Kauff.* On the ground in mixed woods.

Cortinarius glandicolor *Fr.* On the ground in conifer forests after heavy rains. The dark colors of all parts are striking. Easily confused with the stouter forms of C. uraceus Fr. It becomes blackish in age or when dried.

Cortinarius gracilis *Pk.* In sphagnum and other mosses under balsam, tamarack and spruce trees. Much larger than the type. The strict, subcylindrical stems are much elongated, 8–15 cm long. Spores 10–11 by 5–6 microns.

Cortinarius hemitrichus *Fr.* Attached to mosses and much decayed wood.

Cortinarius herpeticus *Fr.* Mossy ground, cedar and balsam swamp.

Cortinarius iliopodius *Fr.* On sphagnum in a swamp of tamarack and spruce. In habit like C. decipiens, that is, slender-stemmed and with a conic-campanulate pileus. In color it approaches C. paleaceus Fr. Spores 10–12 by 5–6.5 microns.

Cortinarius iodes *B. & C.* Among mosses under balsam trees.

Cortinarius juberinus *Fr.* A variety with the apex of the stem violaceous. On deep moss and sphagnum. Spores 7–8 by 5.5–7 microns.

Cortinarius lutescens *Pk.* On low, moist ground, conifer woods. The olive color is more prominent than in the type.

Cortinarius lilacinus *Pk.* On mosses under balsam.

Cortinarius mucifluus *Fr.* In wet places near swamps. Usually referred to C. collinitus Fr. which is a very different plant approaching C. cylindripes Kauff.

Cortinarius malicorius *Fr.* On moss in spruce swamps. Habit of C. semisanguineus, but with dark green flesh.

Cortinarius paleaceus *Fr.* In mossy woods.

Cortinarius persicelis *Fr.* On the ground in a cedar swamp. The slender stem is persistently dark grayish lavender. (Ridg.) Spores 9–10 by 5–5.5 microns.

Cortinarius pholideus *Fr.* On decayed wood and debris in birch and spruce woods.

Cortinarius plumiger *Fr.* In mixed woods, on the ground. A very distinct species. The pileus is 5–12 cm broad, clothed with a dense tomentose-fibrillose covering. The stem, when fresh, is grayish blue-violet (Ridg.) within and without, but this color fades so quickly that it is usually absent. The stem is stout and very fibrillose, sometimes annulate.

Cortinarius pulcher *Pk.* Among mosses, tamarack swamp.

Cortinarius redactus *Britz.* On mosses in conifer swamp.

Cortinarius rigida *Fr.* Among mosses under spruce and pine.

Cortinarius sanguineus *Fr.* Deep in sphagnum, where the stems are often much elongated.

Cortinarius semisanguineus *Fr.* In swamps, on mosses.

Cortinarius subflexipes *Pk.* Under conifers, wet places. One of the smallest species.

Cortinarius sphoerosporus *Pk.* On mossy ground under conifers.

Cortinarius subpurpurascens *Fr.* Under conifers or bare ground.

Cortinarius triumphans *Fr.* Near the top of a hillside covered with birch and balsam. Probably not before noticed in this country. Its characters are those of the plants I found in Sweden.

Cortinarius uraceus *Fr.* On the ground under balsam and spruce. The plants are blackish after they are dried.

Cortinarius vibratilis *Fr.* On the ground in mixed woods. C. amarus Pk. is identical.

Cortinarius violaceus *Fr.* On mossy ground, often deeply embedded by the large bulbous stems in thick mosses. Frequent and copious.

MELANOSPORAE

Psalliota abruptibulbus *Pk.* In mixed woods.

Stropharia depilata *Fr.* In mixed woods of birch, beech and spruce.

Stropharia stercoria *Fr.* On dung hills in fields.

Stropharia umbonatescens *Pk.* On dung hills in woods.

Hypholoma sublateritium *Fr.* Around stumps in woods.

Coprinus tomentosus *Fr.* Among debris in woods.

GASTEROMYCETES

Geaster saccatus *Fr.* In mixed woods of birch, beech, spruce etc. On the ground among debris.

Bovista plumbea *Pers.* On the ground in pastures.

Bovista pila *B. & C.* In fields.

Bovistella pedicellata (*Pk.*) *Lloyd.* On the ground under balsam.

Lycoperdon atropurpureum *Vitt.* Under spruce.

Lycoperdon glabellum *Pk.* On the ground in spruce and balsam woods.

Lycoperdon pyriforme *Scheff.* On wood, logs, stumps etc.

Lycoperdon gemmatum *Batsch.* On the ground and humus, in balsam forests.

Scleroderma vulgare *Fr.* In open conifer woods, on the ground.

Sphaerobolus carpobolus *L.* On much decayed wood and debris.

Crucibulum vulgare *Tul.* On rotting paper, roadside.

Cyathus stercoreus (*Schr.*) *De Toni.* On old dung hills in fields.

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Cryptogamic Herbarium
University of Michigan

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